AMERICAN MACHINIST

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New Iron Planer.

The illustration on this page represents a new iron planer which is made from very heavy patterns, and which embodies some newly patented features. The first noticeable peculiarity is that the parts subjected to the greatest strains are made of unusual size. The bed has great depth and sufficient length to prevent the table from tipping when heavily loaded on the overhanging end. The table is thick, with slot bolts truly planed, and pin holes carefully reamed for convenience in fastening work.

The uprights or posts are very heavy and stiff, having great breadth of base, making it possible to take heavy cuts when the bar is at greatest height from table, without jar or chatter. The uprights are designed to allow the greatest possible amount of light on work.

To enable it to plane surfaces truly, and without chattering, the machine is provided with a powerful train of cut gears, a cut rack on the table, also with shafts of large diameter with bearings double the usual length.

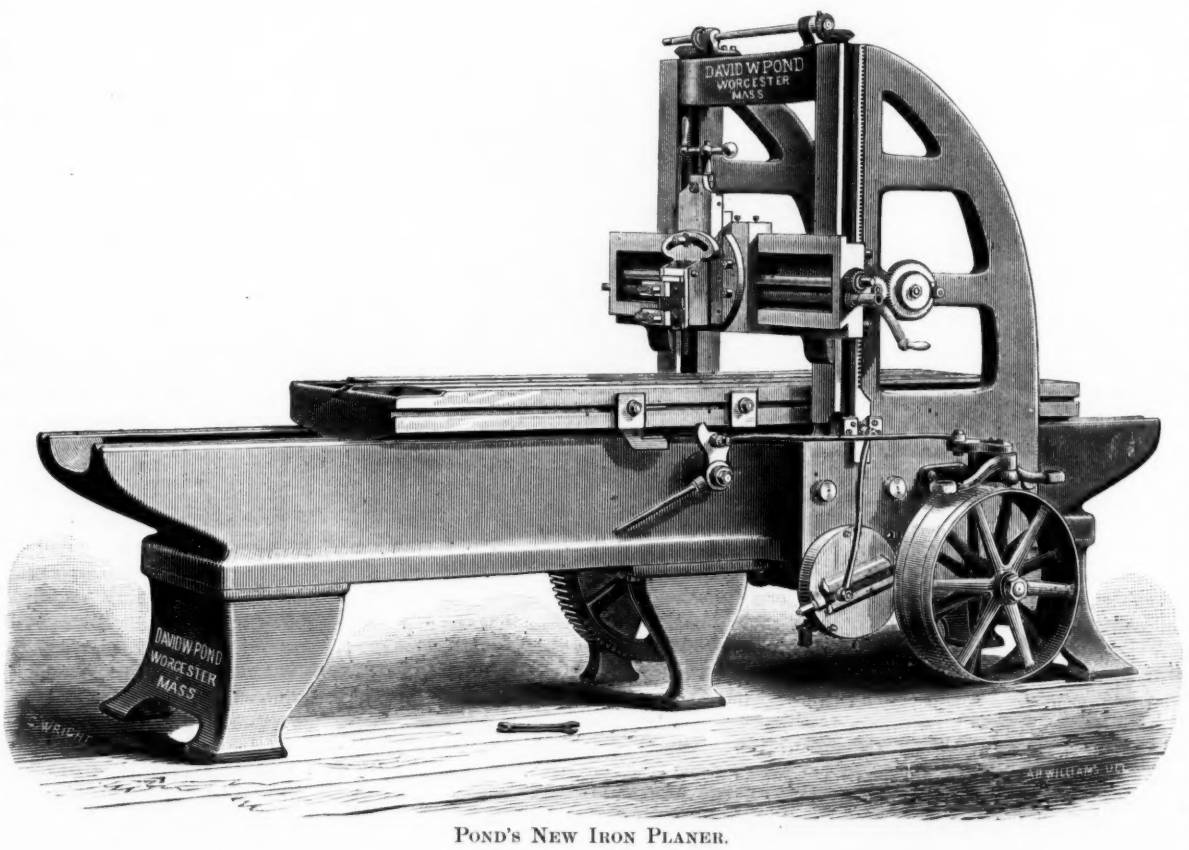
The patented feeding device gives automatic feed in all directions, is adjustable from fine to very wide cuts for finishing, and takes no power except when feeding.

The crank for operating the cross feed by hand can be applied to end of the rod in bar, thus operating the vertical and angular feeds by hand when the handle on the perpendicular feed screw is not within easy reach.

To return the table after the cut, in quickest practical time, can best be effected by open and cross belts, and pulleys of different diameters on countershaft, thus dispensing with extra gears. Speed can be increased or diminished by users to meet their requirements by changing the countershaft pulleys.

The patented automatic belt-shifter transfers but one belt at the same time, thereby preventing two belts running in opposite directions from being on the tight pulley at same time, thus obviating "squealing" of belts and jar of machine. It is entirely disconnected from feeding apparatus, hence works easily, giving the operator quick and perfect control over movements of the table without using the countershaft shipper; is arranged to throw out to clear the reversing dogs on the table which can then be run backward to examine the work. The dogs, not being loosened, retain the necessary strokes and also allow a temporary adjustment of stroke to places not in the limit fixed by the position of the dogs.

This new planer is one of the latest machines brought out at the machine tool works of David W. Pond, Worcester, Mass.



POND'S NEW IRON PLANER.

The two special chances for the machinery designer of to-day grow out of the high prices of paper and ice.

Extracts from Chordal's Letters.

Mr. Editor:

* * * * When the lover of music allows his tastes to degenerate into a knowledge of art, he may bid farewell to the real pleasures of music. When he loses sight of music's high and only office, that of pleasing a natural sense, and sees in it only demonstrations of achievement, he leaves music and approaches art. He cares no longer for what is done. He asks how it is done and who did it. He looks for the signature of the producer, and has no ear for the sweetness of the product.

The painter and the critic bury their love of the beautiful under the distorting glass of a most terrible art. A souvenir of a master takes more value than a master-piece without credentials. Authenticity in the signature becomes of more moment than merit in the work.

* * * * The blighting rigors of arts and artists sometimes get into the shop. The name-plate on a machine will sometimes secure a respected tolerance and defence for the most pronounced failures, and often the meritorious offspring of some interloping nobody will quietly do the proper deed unhonored.

* * * * When we talk of educated mechanics, we mean men who know lots of things outside of their own experience. If they come from schools and colleges, they are well posted as to purity of design and propriety of movements. They know how things ought to be done, and they know how things ought not to be done. They know of applicable principles, and they know of things which won't do.

* * * * Sometimes these poor men, in their walks in the world, discover that the most successful things are those things which won't do, and they often find the proper thing a total failure. Such things make a man sick.

* * * * The most reprehensible bigotry is the bigotry of art, and next comes the bigotry of commerce. That good thing isn't good because *we* didn't make it, and this bad thing *is* good because *we* did make it.

* * * * If an artistic machine designer is of the bigoted kind, and the proprietors have a good share of commercial bigotry, their draughting room is a nice place for a student.

* * * * A student under such circumstances, surrounded by smart but narrow men, will grow more ignorant every day. He absorbs home examples as types of the only correct form, and a departure from these home forms is the basis of his future criticisms.

The susceptible youth spends his young days in an atmosphere of self praise. His world is composed of "we," and the outside "they" are never studied. When this young man goes out into the world he don't meet "we" so often as he expected, and he finds the contemptible "they" all around him. He comes to the conclusion that the world is ignorant.

* * * * I have before told you of the man brought up on tail stocks having the tube screwed on; one day, away from home, he stumbled across one with the snoot cast on solid. He covered the whole ground when he said, "I don't see why they don't screw them on."

* * * * The more cultured a mechanic becomes, and the more he travels, the more he sees of the sickening successes of bad things.

* * * * If we pick up a mechanical work of reference, we find complete detailed descriptions of machines which have a general air of correctness about them. They are placed in such books as types of advanced practice, and the experienced practical man will discover in many of these orthodox arrangements types of the most pronounced practical failures.

* * * * Maybe you don't know it, Mr. Editor; but I claim to be one of these critical mechanics myself. I know good work when I see it, and have tolerably fair ideas of forms. I like to see surfaces of good character, and of proper proportion brought into good contact. I like to see things so shaped as to look right and proper, and I like to see good finish where finish is put. I don't like to see things look wrong all over, in design, workmanship, choice of material, and adaptation, and when I am forced to see them whether I like or not, I don't like to see them doing their intended work with a nicety and perfection, which commands the applause of every ignorant beholder. I see just such things every day.

* * * * Years ago there was gotten up, somewhere in this State, a portable engine for threshing purposes. It was simply known as the New York engine. From an intimate knowledge of this engine, I feel justified in saying that from one end of the machine to the other there was not a detail which the cultured machinist would not criticise. The boiler wasn't calculated anyway at all, its bracing isn't what's called right; it seems to have none of the proportions the books tell of. The cylinder seems wrong for the boiler, and the ports seem wrong for the cylinder, and the valve seems wrong for the ports, and the eccentric seems wrong for the valve. The piston-rod is held in the cross head, and has been held in there for years by a plan which won't hold it, you know. The connecting rod is one of these things. which won't do at all. The main brasses are bored castings dropped rough into the iron pedestals. This won't do, of course; no formula will fit the fly-wheel, so, of course, the fly-wheel is wrong, and all the formulas you can find will twist the main shaft off as the engine starts.

I have seen much of portable engines, Mr. Editor; and I give it as my opinion that this same engine is the most excellent and successful engine in the market—an opinion in which I feel corroborated, by the hard solid fact, that the most successful portable engine-builders in the country to-day are those ten or fifteen men who have copied this engine outright, or with some slight variations in keeping with the general make-up of the engine. Among the sensible copyists, I know two or three who have no respect whatever for the engine they build, but whose success they are bound to respect.

* * * * Many a machine builder of high degree, finds that the real hard work of his life is to battle against the successful things which won't do.

* * * * The machine designer, when he gets cornered, always has a number of plans on hand which are not acceptable. He will say, I can do it this way, but this is no way to do it. I can do it that way, but that's wrong. I can do it this way, but it

would be absurd. I can do it that way, but I don't want to. Such cases produce dyspepsia and baldness.

* * * * Sometimes the same man is disposed to make use of some simple contrivance, which by some reckless springing of parts or imperfection of movement, will do the very thing he wants. The Yankees, I believe, call this manslaughter, and understand its value in a pinch.

* * * * There are devices which will not stand critical analysis at all, but experience shows them to be of the utmost utility. Of this character is the link motion of a locomotive. We can never hope to find such another perfect success of such an imperfect principle.

Another case is found in the running-gear of a buggy or other vehicle. Not a torsion joint about the perfect thing, and flexibility is essential.

* * * * Speaking of things looking wrong, but found to be right, reminds me that George Richards was in my place the other day telling me of an English trick. Tangye's concern in Birmingham, is one of the largest shops in the world. They do an endless variety of heavy work on an extensive scale. I know the shop by reputation, and always feel that any tool which they adopt has real merit. Mr. Richards has been in this shop considerably, and tells me that a chipping chisel in Tangye's shop means a handle with a removable bit set in it.

I made a sketch of this tool to send you, but it got away in transit. If I don't succeed in overtaking it, I will make another and send it next week.

The tool looks as wrong as anything I ever saw, but it is safe to say the Tangyes use good chisels. If any of the AMERICAN MACHINIST readers know anything about these tools they ought to speak up. If they are good tools to chip with there is no question about their advantages. A set of three handles with about a handful of different sized and shaped bits will give a kit of chisels which few visemen in this country ever get hold of. The bits being small can be of the finest steel, something which cannot be afforded by the ton. A stock of dressed bits will save lots of running to the tool-dresser. Here's where some economy comes in. The convenience of the thing suggests itself. The Tangyes use one holder for wide flat chisels, one for narrow flats, and one for diamonds, copes, coltsfoots, round punches, sides, drifts, etc.

* * * * Returning again to the trammels of art, did you ever notice what queer notions some machinists have about finish. They don't seem to care so much about the thing when it's done as they do about the plan of doing it. In railroad shops some one man is always harping on file finish. I have worked in more than one of these shops, and I have never yet seen one of these men who could put a finish on a job with a file. The most he can do is to file a job in good shape to be finished.

This thing of getting the scratches tolerably shallow and very parallel, and then calling the surface a finished one, won't do in these days when we see good finish every day.

A finished job is a polished job. If it's a polish without proper surface under it, it don't look well; and if it has good surface without proper polish on it, it don't look well. A highly finished surface always has a high polish, and machinists condemn it because they can't do it. I like to see a well finished and highly polished surface, and it's nothing to me whether it was done with a rasp or a file, or a grindstone, or a belt, or a grit wheel, or what not.

I have never seen any good polishing which was not done by a wheel or some such rig. I have heard lots of blowing about hand finishing, but I never saw any of the finish worth blowing about.

I saw a ten year old nigger boy in a penetentiary finishing flat irons on an emery wheel, and he was doing work a thousand per cent. nicer and better than anything I ever saw done at a vise.

* * * * Yours Respectfully,

CHORDAL.

Practical Draughting, Copying Drawings, &c.

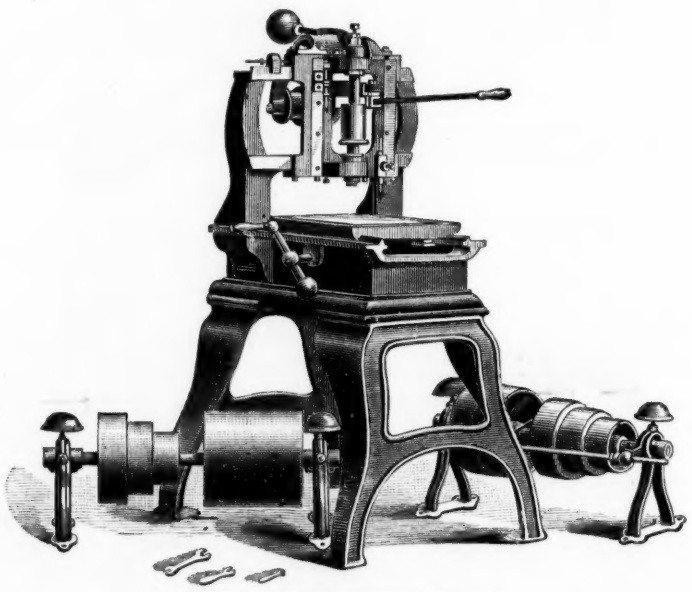
BY T. P. PEMBERTON.

There are several methods for copying and re-producing mechanical and architectural drawings. Some of these have been introduced during recent years, but the plan we shall refer to here is one within the reach and capability of all draughtsmen whether students or experts. As we are writing more for the former than the latter, we have something to say on the subject of copying drawings by tracing them. Thin tracing paper, or tracing vellum cloth, both being transparent, are used for this purpose. The former can be obtained in sheets and rolls; the latter in rolls only. When a copy of a drawing is intended for workmen or when it is likely to receive much handling, the vellum cloth is preferable as it is not easily torn. Copies are made on tracing paper when they are to be mailed or mounted on boards, in a manner we shall explain. The vellum cloth is put over the drawing, and on being pulled moderately tight is secured to the drawing board by thumb tacks. It does not admit of being dampened and stretched; it is pinned down over the drawing without any preparation.

Tracing paper may be manipulated in a different manner. Lay the drawing to be copied squarely on the drawing board, and secure it by thumb tacks. Take a sheet of tracing paper, a little larger than the drawing. By means of mucilage and brush gum down the edges of the tracing paper, but do not pull the sheet tight. After a few minutes take a damp sponge and rub it all over the tracing paper except at the gummed edges. Leave it to dry. In a few minutes the paper will have contracted, and present a beautiful smooth surface, resembling a child's transparent slate. In this condition it is very convenient for drawing upon and coloring. Note, that unlike the process of mounting drawing paper which is moistened *before* being gummed down, tracing paper is moistened *after* it has been gummed to the board *over* the drawing. When the copy is completed, it can be removed by cutting within the gummed edges, and the gummed strips adhering to the board are easily removed by sponge and water. These paper tracings are very delicate affairs, and do not admit of much usage. They have to be "used right side up with care." But if the tracings are for construction purposes they should have the dimensions figured on them, and then they may be mounted on boards in the following manner. Get a smooth pine board ½" thick with battens on the back, a little larger than the tracing. Give this board a coat of moderately thin shellac varnish, white or brown, the former is preferable for this purpose. Turn the tracing over and give the back a coat of same varnish. Before it dries (it dries quickly) lay it as smoothly as possible upon the board. You will find that the air underneath it must be at once expelled, and these air blisters are got rid of by smoothing them out with a smooth cloth or silk pad, stroking out from the center to the sides. The operation requires care and some skill in order to secure a smooth unwrinkled surface, but when the varnish has dried and the tracing has contracted the drawing looks as if drawn on the board. It is a permanent fixture. When pulled tight and it is dry, a coat of shellac varnish may be applied which will render the lines indelible.

This system of taking copies from drawings and mounting the tracings on boards, in the manner described, is practiced in a number of the largest machine works in this and other countries. It allows the original paper drawings to be retained, filed, and kept in good condition in the drawing office, and furnishes workmen with drawings that cannot be torn or mutilated, provided proper care is taken of them. White shellac varnish is easily prepared by dissolving the shellac in alcohol. When making tracings follow the system adopted as the correct one by all draughtsmen, by inking in first the small circles and curves, then the larger ones, then all the horizontal lines, beginning at the top of the drawing and working downwards, then all the vertical lines commencing at the left and moving back to the right, then the oblique lines, last of all the center lines in red (carmine) and dimension and reference lines in blue (Prussian blue) or *vice versa*. The figuring and lettering should be always done with India ink, thoroughly black. The reason why irregular curves and arcs of circles are inked in first is, that it is easier to draw a straight line up to a curve than to take a curve up to a straight line. If tracings are required to be tinted or shaded, the color may be applied before the tracing is cut off, or what is more usual, the color may be applied on the back of the tracing, then there is no liability to wash out the lines. This plan of coloring on the back is adopted for both vellum and paper tracings.

An excellent way of making construction drawings adopted in some English and American works is to have pine boards squared up, planed over and sand-papered, then to wash the surface over with size. A little melted glue in a pint of warm water is generally sufficient for a board of moderate size. When the size has dried, rub over gently with fine sand paper. The board is ready to be drawn on, and may be treated as if paper by first penciling, then inking in and shading up with ink lines. Shading is more quickly and very effectively done by using a moderately soft pencil. The curved surfaces are well brought out by free hand shading. Dimensions can be written on in figures; center and dimension lines put in blue and red, &c. When completed a coat or two of brown shellac varnish, such as is used by pattern makers, may be applied, and a permament, plain drawing is obtained, from which tracings if required can be made in the same manner as from paper. Workmen like such drawings to "work by." When dirty they can be washed. They cannot be torn, and they last a long time. Where there is a number of machines of the same kind to be made, or a quantity of articles of one pattern to be constructed, this is a very desirable plan and useful to architects and engineers. When the drawings are done with, the boards can be planed over, resized and become ready for further use. This is also an excellent way for furnishing drawings intended for forges and blacksmiths.



NEW PROFILE OR EDGING MACHINE.

The engineers running on the Lake Shore and Wabash roads, who reside near the freight yards in this city, says the *Railroader* of Toledo, have a novel way of announcing their arrival to their families. One fellow causes his whistle to crow like a rooster; another makes her holler "over the fence is out, boys;" while another gives five short "toots" divided so as to resemble the stamping of impatient boot blacks in a theater gallery. Their wives, who are always on the alert for these welcome signals, may be seen flying around preparing a warm meal, sometimes in the dead of night, for the head of the family, who is sure to put in an appearance hungry as a bear, as soon as his engine is safe in the round house.

This may be something new and interesting to the people of a Western city, but it's too tame to cause a remark among the citizens residing "up town" in New York City. The engineers on railroads when coming in with a train "in the dead of night" cause their locomotive whistles to play the most unearthly music ever given forth by any machine or instrument. The first note wakes up not only the engineer's wife (if he has one), but all the other wives and babies in a dozen blocks from the railroad. As the music proceeds every cat serenade is hushed and the feline creatures rush in terror for the nearest cover. Toledo engineers may do well as beginners, but if they wish to learn to whistle scientifically by steam, let them come to New York for a few lessons.

On Grindstones.

Discard every contrivance for fixing tools on the grindstone; they are one and all eminently unpractical. A grindstone will not do nice work unless it is kept true, and fixing the tool against it will of course wear it away unevenly. Tools should always be traversed across the face of the stone, and when a flat surface is to be ground by a circular stone, it is clear that this traverse must not be exactly straight across it, or the bevel will be hollow. A very slight hollow is, perhaps, rather an advantage than otherwise in such tools as chisels and plane-irons for wood; but there are numerous cases where the face should be ground as flat as possible. This, as just stated, cannot be accomplished by keeping the tool fixed against the stone. Turning-gouges, again, must be continually swept round in a semicircle on the stone, if the proper form is to be obtained; and, whatever the tool may be, it should be continually traversed if the figure of the stone is to be preserved, which is a matter of the first importance where accuracy in the angles of the edges is aimed at. It is true that some workmen have a knack of producing wonderful edges on stones that run like eccentrics; but this is a rare gift, and the bad state of the stones in many large workshops has much to answer for in the very indifferent character of the metal turning to be found in them. Where all run to one stone, few take any care of it, and it becomes almost a practical impossibility to grind up a slide-rest tool with anything like the accuracy required for first-class toolwork. Regular grinders, however, know the value of a true stone, and are very careful in keeping them so. A true-running stone with a good face will make the workman independent of any rests and holders beyond his own arms and hands. It is true that goniostats are used for very fine and delicate tools where extreme accuracy of form is essential; but these are generally ground on laps running horizontally and presenting a plane grinding surface.

For amateurs' use, nothing is better than a treadle grindstone about 20 in. or 24 in. in diameter; and if the tools are always traversed on it, and it is never allowed to *lie* in —or even over—water, it may be reduced

two inches or three inches diameter by honest work, before it requires turning up again; and the operator will find that when he has accustomed himself to grind true by hand alone, he will seldom want even a rest, and would certainly never think of spoiling his stone by using such an awkward and unpractical contrivance as a fixed holder.

Leakage in Smoke Box.

Insert in the end of tube a drift 4 in. or 5 in. long, turned to fit the tube, slightly tapered and hardened: two or three sharp blows on this will suffice; then run round with small caulking tool. If a bad leak in fire-box end, better take out tube as follows: Remove ferrule, chip off end of tube level with plate in fire box, then with a drift (turned with a shoulder a little less than outside diameter of tube) drive it out from fire-box end, remove slate and scale, anneal ends, and replace (end to project in fire-box about $\frac{1}{8}$ in.), then drift as above. The ferrule, if not too thin, may be drawn a little larger, or replaced by a new one. If properly forged it will require no turning. Having driven the ferrule home, the end of tube may be riveted over to the plate; ferrules are unnecessary at smoke box end. A dolly, or piece of iron to hold on drifts, long enough to clear fire and smoke box doors, is necessary.

New Hand Lathe and New Profile Machine.

The illustration shown on this page represents a new style of hand lathe, which is now being built by E. E. Garvin & Co., 143 Centre St., New York. This lathe is furnished with a strong bed which is supported by legs constructed so as to prevent the vibration which is so objectionable to some lathes. There is a wooden table securely attached to brackets on the back side of the bed, which is 9″ wide, and extends the whole length of the lathe. The spindle is hollow, has a $\frac{17}{32}$ inch hole through it, and is provided with good composition bearings. By the adoption of the hollow spindle, this lathe may be used for the purpose of cutting up stock or making screws, pins, and doing other work. The tail stock is provided with a steel spindle adjusted by a screw. A lever attachment is also furnished with this lathe (shown in the cut), which may be applied to the spindle, and which acts as a quick return motion and gauge. This is very desirable in drilling or manipulating small pieces of work. The tail stock and tool rest are securely held in position by a cam handle, and may be instantly secured or released. This lathe will swing over the bed 13″.

The illustration on the opposite page represents a new profile or edging machine, also made by E. E. Garvin & Co. This machine is for milling the edges, inside and out, of metal forgings or castings of irregular shapes to an exact size and shape of any pattern required. The pattern or former is secured to the sliding bed, which has a forward and back motion, operated and controlled by the hand crank at the side of the machine. The top, or cross slide, which holds cutter spindle and moves at right angles with the bed, is operated by the hand lever in front. This cross slide also has a pin which is brought to bear against the pattern or former, and the four motions to the two slides will allow the pin to follow around any pattern secured to the lower table or sliding bed. The work to be cut into shape is also secured by suitable fastenings to the lower table, and as the pin passes around the pattern, so the cutter spindle will pass around the piece of work and describe the same outline and dimension as the pattern used. By using a cutter with teeth on the lower end, good surface milling is nicely and quickly done. An attachment is made for cutting small gearing for clocks, registers, telegraph instruments, etc.

A Paris ice machine, said to be the first imported, has passed through the Cincinnati Custom-house. It is but a three-horse power, and will make ice for about twenty-five cents per 100 pounds. More are to be imported.

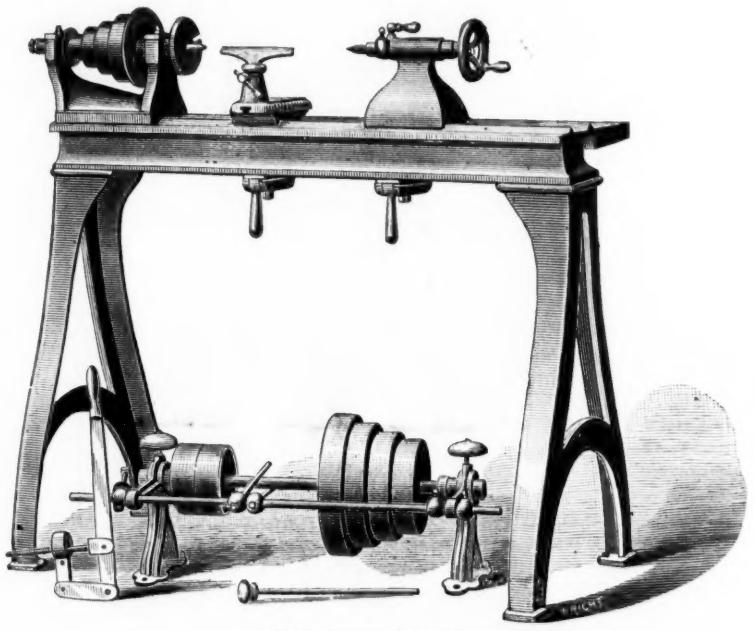
Hints as to the Management of Marine Engines.

BY ALFRED R. WOLFF, M. E.

In presenting a few hints as to the management of marine engines, the writer intends to put on record a few of the points which came under his notice, while practically engaged in this occupation, without attempting any systematic account of the management itself. Some of these may be of interest to the readers of the AMERICAN MACHINIST:

BOILER.

An important point to be considered in the durability of the boiler, is the entrance of the feed water. An ordinary temperature of feed water in marine engines is 120° to 130° Fahr., that is, say, at least, 175° below the temperature of the steam and water in the boiler. The detrimental effect of the repeated action of a large volume of water of the lower temperature, striking a plate of some 300° Fahr. can be easily imagined. To obviate this, a good plan, which has been used with excellent effect, is, to have a feed-water distributing pipe, of the following general construction: The pipe is made to enter a few inches below the ordinary water level, and is carried along the length of the



NEW HAND LATHE.

boiler. By this time the temperature of the feed water has been increased. The feed-water distributing pipe now returns lower down in the boiler and the water issues from a large number of small perforations all along the pipe. This causes the feed water to enter as a number of small globules or streams which are *immediately* heated to the temperature of the water in the boiler, owing to the small mass of each stream.

The effect of *zinc* as a preventive of corrosion can scarcely be doubted any longer. The greater affinity of the combined acids of the oils, grease and copper carried over from the engine, pipes and condenser, for zinc than for iron, causes the zinc to wear away instead of the iron.

FORMATION OF SCALE.

There may, at times, be no means of preventing the formation of considerable scale; however, there can never be an excuse for delaying an effort to remove it. Some standard of concentration of the water should be determined, and "blowing off" practiced to retain that standard. If, on coming into port, after a two weeks' voyage, thorough scaling and washing out of the boiler is resorted to, it will be found that the scale can be removed with comparative ease. Such, at least, is the experience of engineers when cruising in sea water of ordinary densities. By the use of a proper feed-water distributing pipe, as indicated above, of zinc, as a preventive of the deleterious action of the combined acids of oil and copper, and blowing off and frequent scaling, as a preventive of the adherence of scale to the iron, the durability of a marine boiler will be greatly increased.

ENGINE.

In starting up, the engine should always be warmed by opening the "throttle" slightly, and having the pet cocks of the cylinder open. The engine can then be started at the ring of the bell, even if not "turned over" beforehand, and no vacuum formed. However, it is always well to let the engine make a few slow revolutions, to see that everything is in order, and that no serious leak in packing or in pipes exists. Before feeding water to the boiler, use the salt water injection of the surface condenser to wash out the condenser, thus pumping the grease or dirt that may have settled overboard. The feed pumps should never be started while the engine is running at full speed, as a sudden heavy influx of water tends to weaken or burst the feed pipe.

VACUUM.

As a general rule, in ordinary marine engines, 24.5 to 25 inches of vacuum will be found the most economical to retain. The state of the vacuum depends upon the amount of vapor mixed with the water in the air pump. The more vapor, the poorer the vacuum, and, at first sight, it would appear as if the best plan were to give sufficient injection water to the condenser to condense all the steam and thus exclude vapor. However, by doing this, the temperature of the feed water is lowered, and so even in engines where 29.5 to 30 inches of vacuum are easily obtainable, it will be found more economical to have a lower vacuum and a higher temperature of feed.

HEATING OF BEARINGS AND ITS PREVENTIVE.

Even when bearings are in apparently good order, and oil is being regularly supplied by wicks, heating frequently occurs. The slightest amount of grit, a small, almost imperceptible projection on the brass, or the engine shaft being a little out of line—all will cause heating, especially if an increase of speed takes place. Facilities for cooling by the external application of water should always be provided. The crank pin is one of the most unreliable parts of the machinery as far as heating is concerned. It has to withstand not only the direct pressure of the steam and the weight of the moving parts, but this pressure is exerted while it is moving in a large circle. The usual method of applying cold water is to have it strike the crank pin at the highest point. Thus the crank pin receives water directly only at one point of its surface, and for a short interval in each revolution. An excellent plan to reach the crank pin at every point of its exposed surface and during the entire revolution, and one which gives very satisfactory results, consists of two pipes connected to the ordinary water pipes along the side of the surface condenser, both overhanging the full travel of the crank. These pipes are perforated, causing a steady stream of water to strike the crank pin in every position. When the crank-shaft bearings begin to heat, on account of receiving too little oil or for other causes, and the engine labors and tends to slow, the engine ordinarily should be stopped at once, the bolts of the bearing slacked up a little, more oil given to the journals and more water applied externally, and then the engine should be started up slowly. The bolts of the bearing can then gradually be tightened down, watching the bearing closely all along. On some vessels, the engineer of the watch has the right to stop the engine when, in his opinion, there is immediate necessity, and *then* report the cause to the commanding officer or officer of the deck. In case of serious accident this ought always to be allowable, for an engineer of good judgment can usually compare the danger to the machinery of not stopping and the possible danger to the vessel of stopping, better than the deck officer, who knows the latter but cannot estimate the former. A good rule is, when some extraordinarily peculiar threatening noise is heard, to slow down or stop at once. The following case came to my knowledge: A sudden and very violent thump of the engine was heard. The engineer of the watch, becoming confused, looked at the vacuum gauge, which indicated correctly, opened the thermometer recording the temperatures of the injection and feed water, and made other equally wrong and more ridiculous moves, while the "pounding" continued. Finally he reported the fact to the chief engineer, who, awakening, gave orders to stop at once. The nut of the air-pump foot valve had become loose and disengaged; had the engine been stopped at once, but slight damage would have been done. As it was, the bolt, repeatedly striking the nut, was entirely bent and partially broken, and the consequence was—the air-pump had to be taken apart, the vessel was delayed for a day, and the whole engineer force had to work night and day to repair the damage, congratulating themselves at the same time to get out of the dilemma so easily. The engine should have been stopped at once, and moved slowly to find the cause of the jar. Besides knowledge and experience, good judgment and courage are the main requisites for an engineer of a vessel. It will not do for him to tremble when in a fog, even if for days, and start up confused and helpless when the bells are given to him. More than one such case is on record, men of some knowledge and considerable experience, too, who would do first-rate in charge of a stationary engine, but who ought to leave marine engines "severely alone."

TAKING BUCKLES OUT OF SHEET IRON.—The tools generally used are as follows: A large cast iron plate, about two feet diameter and two inches thick, with the face a little convex (it is called a setter), and a hammer of about 4 lbs. or 5 lbs., about two inches flat face. Hammer the sheet iron wherever it is tight, or where it does not buckle, so as to stretch it equal to where the buckles are; by so doing you will bring it flat, but this requires patience and practice. A large plate of iron, as above stated, is the best to set your work out on; because you can more easily see the extent of the buckle, and where the tie is located that requires to be hammered. The process can be made much easier by passing the sheet iron through a pair of rollers such as are used by tin and iron plate workers.

MAGNETIZING STEEL BARS.—In magnetizing steel bars by means of a coil, M. Righi finds that on taking bars of the same steel and the same diameter, and decreasing their length, a certain length is arrived at which no longer yields any magnetization, whilst smaller lengths give a permanent polarity opposed to that of the coil.

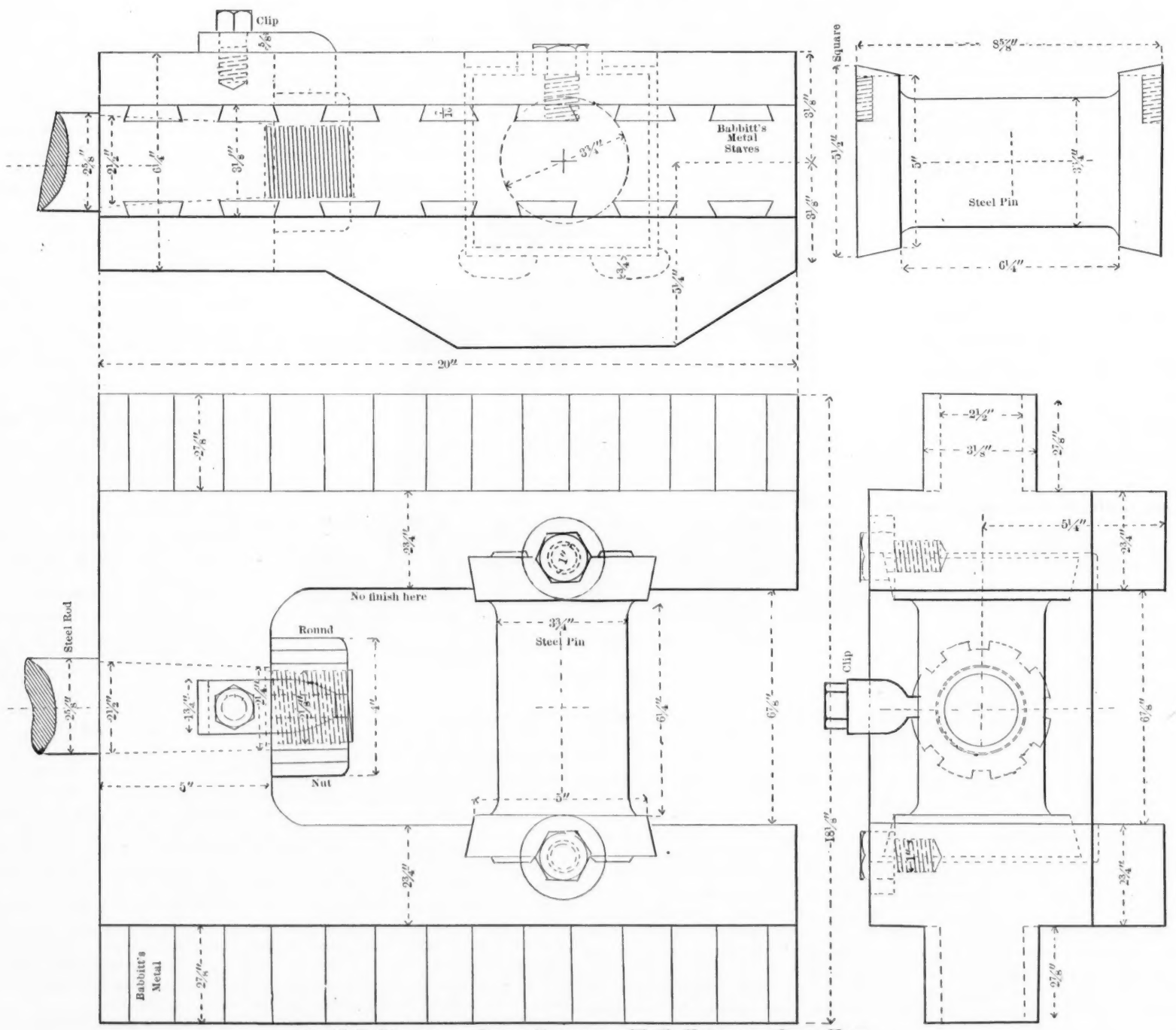
ANOTHER INTERNATIONAL EXHIBITION.—An international exhibition of boats, nets, tackle, and all other matter pertaining to fisheries will be held in the spring of next year in the fishing village of Scheveningen, Holland. The Chevalier Teding von Berkhout, of Amsterdam, is chairman of the committee for programmes and catalogues.

Working Drawings of a Steam Engine Cross Head.

The cross head of W. H. Hoffman's 100 H. P. engine was described in his articles on Engine Proportion and Construction, which appeared in the AMERICAN MACHINIST, July 26 and August 2, 1879. In this issue we present a working drawing of the cross head.

The cross head is made of cast iron, or, if desired, of steel casting. In the latter case cores are introduced to lighten the casting. The pin is separate and is made of *forged* steel, is planed in to cross head, all sides or collars beveled alike in order that the pin may be turned over when worn *without returning* in lathe. This provides for the life of the pin during that of all other main details. The piston rod is held to cross head by a round nut, and this in turn is held by a clip to prevent its becoming loose. There are no gibs, babbitt-metal staves being substituted. Where engines run backwards, or the top crank circle toward the cylinder, the cross head is simply inverted in the slide bars. The length of these cross heads is *always* two-thirds of the stroke, and they will never heat, cut, or concave the slide bars.

Scale 3″=1 foot.



100 H. P. HORIZONTAL STEAM ENGINE, BY W. H. HOFFMAN.—CROSS HEAD.

Improved Plan for Street Sprinkling.

Before the Engineers' Club, Col. Henry Flad explained a new device for sprinkling the streets direct from the waterworks' mains in a very rapid and efficient manner. The apparatus consists of three sections of four-inch wrought iron pipe connected between and at the ends with a hose and couplings, the pipe section being mounted on wheels for convenient transport. In connection with each section of pipe is arranged an automatic sprinkling nozzle so adjustable that it can be readily adapted to any width of street The apparatus is so constructed that half a block is sprinkled at a time and ten blocks can be sprinkled in an hour. The connection being made with the waterworks mains insures a full head of water and very rapid and thorough work. The apparatus has been constructed with a special view to sprinkling residence streets at night and not sprinkling them at all in day time. It is not intended to use the sprinkler on streets occupied with heavy traffic which require repeated wettings during the day, and inasmuch as about three-fourths of the residence streets of St. Louis are not traffic streets of any considerable extent, the application and use of the machine would seem to have an extended field for use. According to Col. Flad, the cost of sprinkling would cost about one-tenth what the present mode of sprinkling costs. Those interested in such matters may have an opportunity to see the apparatus at work in Carondelet, where it has been repeatedly tested.—*St. Louis Journal of Commerce.*

Shop Esthetics.

BY F. F. HEMENWAY.

I should like to refer Chordal's concluding opinion in a recent number to the gentleman in question, Mr. Worthington. A great many people in the world are profoundly impressed with the idea that he began at the right end of the pump question. Likewise that it was a good thing for the mechanical world that he did begin at that end, and they make. They educate ignorance up to demanding what is best.

When Mr. Corliss made the first girder frame, he didn't make it because there was a demand for it. He made it in spite of a demand for something else. There wasn't any mechanical difficulty in the way, but there was a commercial difficulty in the way, consisting of the prejudices of several generations. If Mr. Corliss has educated the mechanical fraternity up to admiring the girder frame, and if it is really the best, he has done a good thing, and it is well known that in connection with other enterprises his material interests have not suffered, which is also a good thing. What Chordal would call "the high and mighty" in the machinist line may not always seem as expedient as it really is. But if it is not always expedient, it is worth noting that those who have achieved signal success in that business have worked up on that track. It has to be well followed to succeed. Imagine a customer applying to any one of the first-class, high and mighty engine builders, for an engine in which slop work was substituted for their usual refinement! It wouldn't take him long to find out that he couldn't buy such an engine from him at any price. Forty years ago there wasn't a shadow of demand for such work. To-day the whole world, in common with these men, is better for this demand having been created. The parties referred to sell their work for a good price, because they adopted the high and mighty style; and their customers demand such work, because association with it has educated them to appreciate it. But there is another point in this connection. Such men don't have their minds eternally grinding around to make money. They do make money, and they intend to, and ought to, but they make some thing else; they make good machinery. Their ambition is for producing something that makes things better for others. The difference between the high and mighty, and the low and feeble in the machine business, is that the representatives of the former deliver something better than they sell; the latter something poorer. It is unnecessary to institute comparisons of the effect upon the individuals in question. It isn't considered entirely contrary to nature, or, at least, not contrary to grace, for a lawyer to defend a client, or for a physician to prescribe for a patient, without hopes of immediate pecuniary reward.

If a machinist asserted a willingness to sacrifice any of his chances of immediate gain, for the prospective good of the craft, he would be set down as a knave or fool with

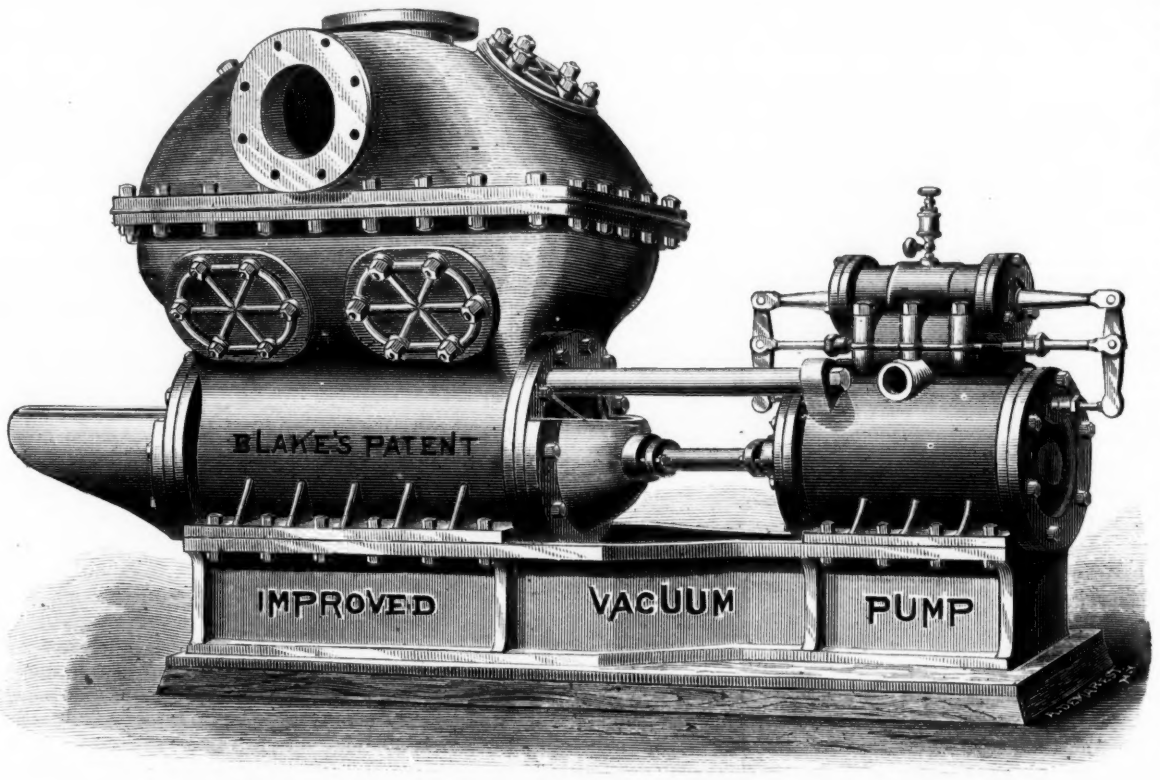
the least possible delay; and yet it is just possible this may sometimes be the case. Men in every other line of business occasionally show a desire to build up a reputation that isn't altogether and entirely connected with dollars and cents. Is the machinist the only exception, or is he an exception? It may not be true, but it is rather pleasant to believe, that many men would use invisible wedges and T head connecting rods, if they didn't honestly believe the key to be the better device; as also that many domes are put on boilers because the builder believes in their utility. * * * If Prof. Sweet would tell Joe (not Chordal's, but some other Joe), what to do in the event of his going into the shop, with no probability of a future ability to go to college, he would do a good thing. There are a good many Joes who know it would be a good thing to go there, either before or after a shop experience, just as well as they know of the probability of being unable to follow their inclination in the matter; but the fact that they are already educated to see the utility of such a course, is proof that they may be able to do without it, if their zeal is properly directed. Those most excellent institutions of learning are mainly valuable to teach young men how to educate themselves systematically. The educating process, proper, goes on through their lives. Now, what Joe needs, first of all, is to learn how to learn. What sort of mental training should he put himself through, and how and where shall he begin? He has made up his mind to be a skillful workman, but he has made up his mind to be a good deal besides, and he finds himself in the condition of having two trades to learn. How to go about the intellectual one is what he needs to be told. It won't altogether do to say he will find out for himself what his needs are. That would be equivalent to a machinist starting out in the manufacture of steam engines without any knowledge of what others had done and learned in that direction. He would get discouraged, or die from natural causes, before achieving any success. He might expend energy enough to build a dozen engines, but he would expend it in unprofitable directions. The danger is, a good many Joes will do the same thing. Nature puts a check on the useless expenditure of vital forces, by interposing discouragement. There is one point in the apprenticeship question, which, in the absence of any written law, ought to be settled by some sort of universal consent. If Joe goes into Smith's shop, he goes to learn as much of the trade as he can in the short period of three years. He naturally reasons that when he has learned to do one thing well, he ought to begin at something quite different. Now, from a business point, Smith hires Joe to increase his profits, and just as naturally reasons that while he has been learning to do this thing, he (Smith) has been losing money paid in wages, losing money represented by material wasted, and losing money represented by interest on cost of plant, etc., therefore Joe must work this out by keeping at what he can do well and quickly. The difficulty is, both parties are right, and both parties are wrong.

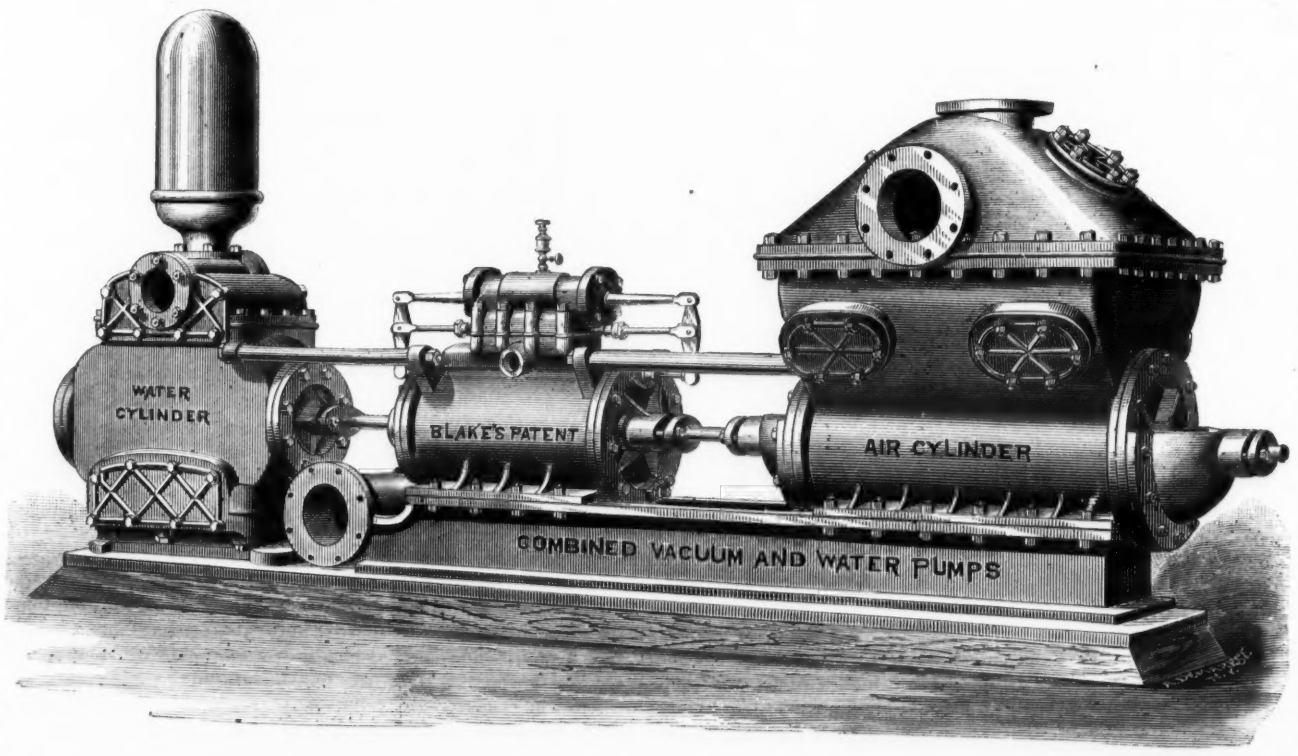
One other difficulty in the apprenticeship question is in the matter of instruction. Every one, interested and disinterested, goes for the foreman on that. Take the case of what Chordal would call a simon-pure machine shop, running on everything, from a 150 H. P. engine to a sewing machine needle. The usual condition in such shops is, the foreman making his own drawings; always ready to talk for an unlimited time with a customer; supposed to know what every man is doing, and how he is doing it, likewise why it takes him so long to do it; hanging up the shop and attending to outside business without notice; keeping up the supply of stock and material; able to tell in four minutes what is the matter with Snyder's engine, how long it will take to overhaul it, what it will cost, and how much coal Snyder will save by the operation; carry the size of all the gearing in twenty-seven miles, and the dimensions of all the crank pins within a radius of ten miles right around with him; get along with two-thirds cheap help, and instruct three or four apprentices. Add to this, that he is expected to do whatever there isn't a regular appointment for, and then, Query: How much time will he have to devote to the apprentices?

New Direct-Acting Vacuum and Water Pumps.

In our issue of April 3, 1880, we illustrated the process of sugar making by the aid of the single vacuum pan and triple effect evaporating apparatus, operated in connection with a direct-acting vacuum pump. We now illustrate two forms of these pumps in detail.

Until within a few years it has been conceded by manufacturers of pumping machinery, that vacuum pumps could not be successfully made on the direct-acting plan. In this pump it is claimed that careful designing of the air cylinders avoids all annoyances from air pockets, while the vacuum formed is so perfect that the mercury column will measure within ⅛ inch of a perfect vacuum. Simplicity of construction and economy of erection and operation are also special points claimed in favor of these pumps.





The first engraving represents the plain vacuum pump without the water cylinder. Its principle is the familiar one of the water piston; the water plunger displaces the water, the latter being the piston proper. Two large compartments and passage ways in the water cylinder permit the rising and falling of a column of water alternately. When the piston is at the extreme end of the stroke, the water in one of the two compartments has expelled the air and completely fills the compartment. In the other compartment, the water correspondingly falls almost to the level of the cylinder proper, through which movement a vacuum is formed, and so on alternately. The suction connection is on the top of the large double cylinder, the delivery connection being at the side.

The inside head of the air cylinder through which the piston rod works, has a water basin, arranged so that the main stuffing box is always sealed with water, thus preventing any possible leak of air through the gland to deteriorate the vacuum.

The steam cylinder has a positive movement, so that the pump can be run at the slowest speed necessary, without danger of centering.

The second engraving represents the vacuum pump with water cylinder added, which is intended more especially for use on sugar plantations, in which case it pumps water to the cooling tower or condenser, acting as a substitute for an auxiliary pump.

In both these pumps, the peculiar character of the design permits the valve areas in the air cylinders to be made exceptionally large, by which means the pumps are enabled to work on the wet as well as on the dry system. The valve seats, valve bolts, linings, piston rods and stuffing boxes of the air and water cylinders are of composition substantially made.

The manufacturers are the Geo. F. Blake M'f'g Co. of Boston and New York.

MATHEMATICAL INSTRUMENTS, ETC.—All polished steel instruments are best kept from rust by enclosure in wool. The high conducting power of metal causes easy condensation of moisture (the cause of rust); wool is a good non-conductor of heat or cold.

Two mechanics, (lately landed), who had formerly been intimate associates, but who had not seen each other for a good while, met the other day. After passing the usual greetings, one remarked to the other: "If the Lord spares me, I'll come an' see thoo next day." A third mechanic, also a new arrival, happening to come up at the time, heard the remark and said: "Aa think the Lord will be badly off for hands if he cannot spare thoo."

Cotton waste may be thoroughly cleansed from oil and grease in the following way: It is put into an iron furnace (heated with steam from a pipe led into it), together with a little black soap and soda. The action given to the water by the rushing in of the steam keeps the waste continually moving, thus freeing it of its impurities. After boiling for about two hours, it is taken out and laid on a boiler or warm place till dry.

Wind mills have of late been quite an item of export from this country, fifty of them having gone in one shipment to New Zealand, as well as shipments to France, Portugal, Spain, and South and Central America.

Useful Device for Truing Crank Pins.

BY L. F. LYNE, M. E.

It used to be the plan when the crank pins upon locomotives became worn, to either true them up with a file or replace them with new ones. There were many objections to the former process as the pins were generally worn more upon one side than upon the other, which afterwards caused a complication of affairs as the cranks passed the head centers; moreover, in tramming the pins before hanging the rods, it was found very difficult to adjust the rods to the right length for all positions of the crank.

When these engines were sent out upon the road, more or less trouble was always caused by heating of the pins. Numerous devices and tools have been made for truing up the journals upon the pins without removing them from the wheels, some of these have succeeded and some have not.

The writer some years since designed a simple and economical device to be applied to a boring bar upon a wheel lathe, which was afterwards used upon a "quartering" machine.

Referring to the accompanying illustration, *b* represents the spindle or boring bar attached to the boring apparatus of either of the machines previously referred to, which has a wrought iron crank, *c*, fitted to the end. This crank is held in position by a feather key and set screw, so as to be easily attached or removed. An adjustable square bar, *d*, is placed through the square hole shown at *G*, care being taken to make a neat fit, as the success of this tool depends largely upon the pains taken in making it. A square hole is also made through the end of the bar *d* for the reception of the tool *e*; this tool may be pushed forward at each revolution of the bar by means of a small wrench applied to the screw *f*. To use this device a pair of driving wheels are to be hung upon the centers, attached to the machine, and the wheels rolled around until the edge of the collar upon the crank pin, *a*, may be an equal distance from the edge of the tool, *e*, as it revolves. The wheels after being set properly should be firmly clamped, the face of the journals may then be trued up without further detail. This device performs its work in a very satisfactory manner, it has been in use for about eight years and is considered among the indispensable tools in the shop where it is being used.

It is not only applicable to the purpose named, but may also be applied to the spindle of a drill press, and used for many different kinds of work; its advantages will be readily recognized and appreciated by the practical mechanic.

A few suggestions might be thrown out here in reference to placing fillets at both ends of the journals instead of at one end, as the rod brasses may then be changed from one side to the other, or the right hand rod may be placed upon the left hand side. These and other advantages are very useful in emergencies. Fillets at both ends of the journal give better results than when placed only at one end. I am not aware of any patent upon this device, and believe that any one has a right to use it.

Letters from Practical Men.

TEACHING THE MACHINERY BUSINESS TO PROPRIETORS' SONS.

Editor American Machinist:

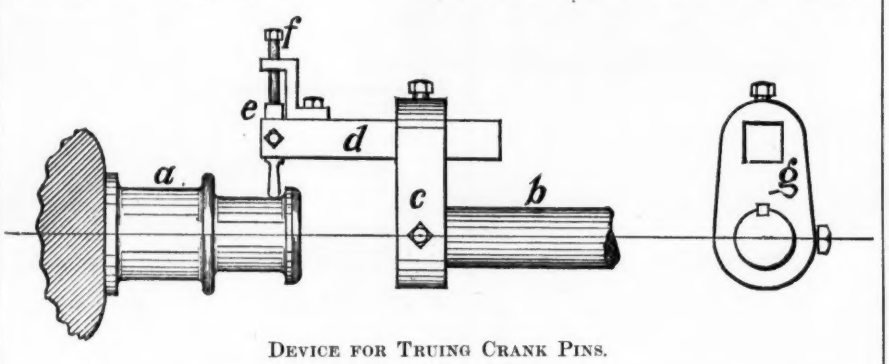
I have been a subscriber to your valuable paper for over two years, and have been greatly pleased with the writings of several of your correspondents, particularly with the letters of Chordal on the management of machine works; but I think that he forgot to treat one important feature of the disastrous results ensuing from taking proprietors' sons and relations into the works for the purpose of teaching them the machine business. I have had an experience in that direction gained by some twenty years' occupation as manager of a machine business. During that time it has been my bad luck to have had such sons and relations placed under my charge, and they have caused more trouble than a hundred strangers would have done, never being satisfied with their allotment of work or wages, and always carrying home to their parents stories of discontent. You may be sure that it never made any difference what I had to say in response, as the fathers would take their darlings' versions in preference to any other. Such sons have been boasted of by their fathers as the best workmen in their shops, thus leading them to believe in their superior ability. Forcing a boy along to gratify some member of the firm always appeared to me as senseless as the cramming of French verbs into the heads of twelve-year-old school boys. I have known dissolution of partnership to be caused by the sons and relations of proprietors.

Mr. Editor, I would be pleased to hear from you or some one of your correspondents on this subject.

Yours respectfully,

HENRY PARSONS.

Newark, N. J., May 20, 1880.



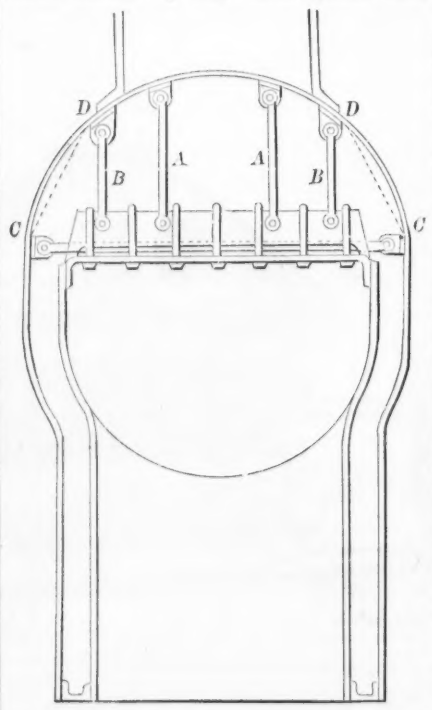
DEVICE FOR TRUING CRANK PINS.

BRACING BOILERS.

Editor American Machinist:

The remark of Mr. Hoffman, in your issue of the 8th of May, implies that he doubts the ability of side sheets of the inside fire box to sustain their legitimate share of the load upon the crown sheets, and, consequently, that bracing of the crown to the shell is necessary as a means of relieving the side sheets.

If we consider the extent to which the side sheets are supported vertically, by the fire box heads, along the top edge, by the crown sheet, at the bottom edge, by their connection with the shell, and throughout their entire surface by stay bolts, spaced, each



way, about 4½ to 5 inches apart, we shall discover no reason for supposing them in any way less able to sustain the depressing strain upon the crown, than any other part of the boiler is of an equal tensile strain. In fact, the practical working of steam boilers has never shown any weakness of the side sheets in that direction.

To aid us in getting an accurate idea of the effect of introducing braces connecting the crown to the shell, let us refer to the accompanying drawing, which is a transverse section through the fire box, showing the crown sheet, crown bars and four lines of vertical braces connecting the crown to the shell with crow feet in the usual way.

I do not, at this writing, go into calculations for the purpose of showing approximately the difference in the expansion of the inside and outside fire-box sheets. It is sufficient, for our purpose, to keep in mind, in a general way, that their expansion varies with their temperature: that the inside sheets being exposed directly to the action of the fire are necessarily many degrees hotter than the outside sheets, consequently their expansion is relatively greater; as a result of this greater expansion of the inside sheets the crown becomes elevated to an extent equal to this difference. This elevation of the crown continues during the whole working of the boiler, varying from time to time with the temperature, mainly.

This elevating of the crown produces an upward thrust towards the shell through each vertical brace *A*, *A*, and *B*, *B*. The natural result of this is a bulging outward of the shell directly over the end of each brace; whatever resistance the shell offers to this upward thrust of these braces, becomes a depressing strain upon the crown, which, together with the steam pressure, tends to force the crown sheet down. Should the crown bars be sufficient to sustain the load upon the crown sheet with a deflection less than the elevation of the crown by expansion, then the upward thrust through these braces will continue during the working of the boiler, and the presence of these braces will be the direct cause of a considerable augmentation of the depressing strain upon the inside fire box.

Let us consider this again under circumstances somewhat different; we will suppose the crown under its legitimate steam load has become depressed at the center to an extent sufficient to cause a tension strain upon the two middle braces *A*, *A*; any further increase of the load upon the crown will be sustained by these two lines of braces, and the further deflection of the crown prevented. The outside lines of braces *B*, *B*, being connected to the crown bars almost vertically over the edges of the side sheets, at points where the natural deflection of the crown, must be too insignificant to be of any practical consequence in relieving these braces from the upward thrust of the crown due to expansion; hence during the whole working of the boiler the upward thrust through these braces *B*, *B*, has to be resisted by the shell, causing, of course, a corresponding depressing strain upon the side sheets of the fire box. At no time can such braces come into action so as to sustain a tension strain, when they are fitted with close fitting pins, &c., so as to prevent any lost motion, which is often the case; the thrust on the shell is considerable which naturally bulges the shell outwards; this takes place only by astraightening of the shell between *C*, and *D*, as shown, exaggerated, of course, by the dotted lines; this means a sharp and positive bending of the plate along the edges of the two lines of crow feet at *C*, and *D*, the fatally destructive effects of which were so clearly shown by the destruction of the boiler of the locomotive "Lehigh" a few months ago.

This reasoning shows that the presence of the braces *A*, *A*, and *B*, *B*, is a direct cause of augmented strain upon the crown and that the absence of such braces would be a relief, not an aggravation as Mr. Hoffman supposes: It further shows him to be in error when he says, "every tension support fastened to the roof rafters will bear its full share of the total load upon the crown sheet."

To have a just realization of the fatal effects of the sharp and abrupt bendings resulting from unequal expansion, we must bear in mind that during the ordinary working of steam boilers the legitimate strains from steam pressure only, are nearly equal to the elastic limit of the material; that the maximum strains from steam pressure are coincident with the maximum strains and bendings resulting from unequal expansion, which should abundantly explain why unequal expansion, in its effects, should be so fatally destructive. It should also explain why the lines of deterioration should conform to the natural lines through which these destructive effects are transmitted, and lines of fracture through solid plates, parallel to and only an inch or two from lines of "punched" and "drifted" rivet holes should occur, whilst the plates at the rivet holes show no sign of weakness. It shows that the lines suffering the effects of unequal expansion are really the weak lines of steam boilers, and that they demand more serious attention from engineers than do the proportions of riveted seams, etc., or the effects of bad workmanship.

W. H. THOMPSON, M. E.

Cleveland, Ohio, May 10th, 1880.

GEARS FOR SCREW CUTTING.

Editor American Machinist:

Several articles have appeared in your paper lately on change gears, and how to calculate same for screw cutting in engine lathes. If you have not had enough on this subject try this: Twenty-five years ago I asked a "cute" journeyman machinist how to calculate change wheels for screw cutting. "Multiply the number of threads per inch in the leading screw of lathe and the number of threads per inch you want to cut by 6'," was his answer. This is all right, except that 6 or any other number may be used for multiplier so the products may be found amongst the changed gears of lathe. Example: Required to cut sixteen threads per inch on lathe with leading screw four per inch—

$16 \times 6 = 96$ on screw.

$4 \times 6 = 24$ on spindle or equivalent.

It is understood that when thread to be cut is of finer pitch than leader, the largest of the gears will go on screws, and *vice versa*.

Take the same routine for fractional threads. Example: Required to cut $11\frac{1}{2}$ threads on same lathe—

$11\frac{1}{2} = \frac{23}{2}$ and $23 \times 4 = 92$ on screw,

$4 = \frac{8}{2}$ and $8 \times 4 = 32$.

Another example on screw lathe. Required to cut $3\frac{1}{2}$ threads per inch—

$3\frac{1}{2} = \frac{7}{2}$ and $7 \times 5 = 35$ on screw,

$4 = \frac{8}{2}$ and $8 \times 5 = 40$.

The lathe I have in mind has gears to meet above wants. Any other multiplier will do as well.

Yours truly,

A. S. ALDEN.

Holyoke, Mass., May 24, 1880.

VARIETIES OF WIRE GAUGE.

Editor American Machinist:

The remarks of Chordal on the subject of wire gauges, like all his articles, appear to me well-timed and to the point. I am disposed to adopt the suggestion, that the origin of the wire gauge was, that some one made a wire and then filed a notch to fit it. It is highly probable that, in the days before the flood, there was a complete set of these notches in existence, ranging in regular gradations from the coarsest to the finest; but Noah was doubtless obliged to set sail on his remarkable voyage with an incomplete set, causing thereby the present irregularities. If by any means, archæological explorations, or otherwise, those lost notches of the antediluvians could be found and restored, we might reach a standard which would be better than guessing.

To be sure, the only advantage over the present custom would be the existence of notches instead of blank spaces, but even that is an improvement, and might prove a blessing in disguise by introducing new complications and compelling the public in sheer despair to adopt Chordal's suggestion of a wire gauge, based on the metrical system, which I most heartily endorse.

Truly yours, JOHN ADT.

New Haven, Conn., May 18, 1880.

GAUGING STOVE PIPE.

Editor American Machinist:

Chordal's last on wire gauges reminds me of some early experiences among the stove dealers throughout the United States, and I would respectfully suggest that some self-sacrificing individual, who wishes to perform a mission, would find an abundant field in issuing a tract entitled: "Uniform Sizes in Stove Pipes as a means of grace." I am certain that a liberal number distributed among our metal dealers would have a wholesome effect. A number of years ago, in his callow days, the writer conceived the idea of stamping out stove pipe elbows by machinery, with a view to displace the old method of cutting them out by hand, in vogue in retail tin shops. Following out this idea, he traveled throughout the country introducing the "Patent Stove Pipe Elbow," which he had made of standard size. A 4 inch elbow was 4 inches inside measurement at the large end, a 5 inch and 6 inch likewise, with sufficient taper to permit the small end to enter a hole of the same dimension. Fully equipped with samples he sallied out, vainly imagining that he would capture the whole trade, but he "reckoned without his host." Mr. A's 6 in. pipe was 6 in. at the large end, and $5\frac{3}{4}$ at the small. B's was 6 in. at the small, and $6\frac{1}{8}$ at the large end; 5 in. pipe was $4\frac{3}{4}$, $5\frac{1}{16}$, $5\frac{1}{8}$ or $5\frac{1}{4}$ at random. In the same town no two men in the trade made the same sizes, and it was so wherever he went throughout the length and breadth of the land. Some proprietors were honest enough to admit that they made a different size from Smith or Jones, in order to prevent Smith or Jones from getting their customers away when moving day came, and said customer stood in dire need of an extra joint of pipe or elbow, while setting up the kitchen stove.

But the diabolical part of the whole proceeding consisted in the fact that the innocent customer vainly imagined that a 6 in. pipe was the same thing from either shop. As a consequence, he made a terrible page in the book of the recording angel in black ink every time a stove was moved, and additional pipe required. I am told that certain shrewd and far seeing machinists keep a different size of screw threads from their neighbors, in the same town, for the purpose of securing the job of repairing such machines as they may sell. Chordal's remarks on the wire-gauge question brought back forcibly to my mind those early experiences, and as a householder needing to buy an occasional stove, but more especially as a manufacturer, employing some 300 hands, and requiring tools, I raise a feeble wail for uniformity in stove pipes and screw threads throughout the country.

Respectfully,

EDWIN NORTON.

44 & 46 River St., Chicago, Ill.

Pattern Making—Building up Work.

BY L. F. LYNE, M. E.

The first and most important precaution in making patterns is to see that the wood to be used is well seasoned, otherwise much trouble will be experienced, owing to the continual changes which take place in the pattern, from the shrinkage of the wood.

In building up a pattern it is always better to make it of small pieces of wood in order to avoid the possibility of using badly seasoned lumber; moreover there will be less danger of the article changing its shape when finished. Greater strength will thus be given to the pattern, which is a very essential feature, as in the case of light-turned work, such as packing rings for steam engines, rims for pulleys, etc.

For straight work large single pieces are sometimes admissible, provided that the timber is well seasoned, but never in curved work. The thinner the pieces or layers the better will be the pattern, which proportion may of course be varied to suit the size of the pattern required. If it be necessary to make a flat pattern, as, for instance, a steam chest cover for a locomotive, a good plan is to take a well seasoned board about 1" thick, dressed on both sides, and rip it up in strips corresponding in width to the thickness required for the pattern when finished, making due allowance for dressing up on each side. These strips are to be placed edgewise against each other, and carefully glued together. By this process the grain of the wood is changed, and if the gluing be properly done a strong and serviceable pattern is secured, from which any number of castings may be made without changing its size or causing it to warp.

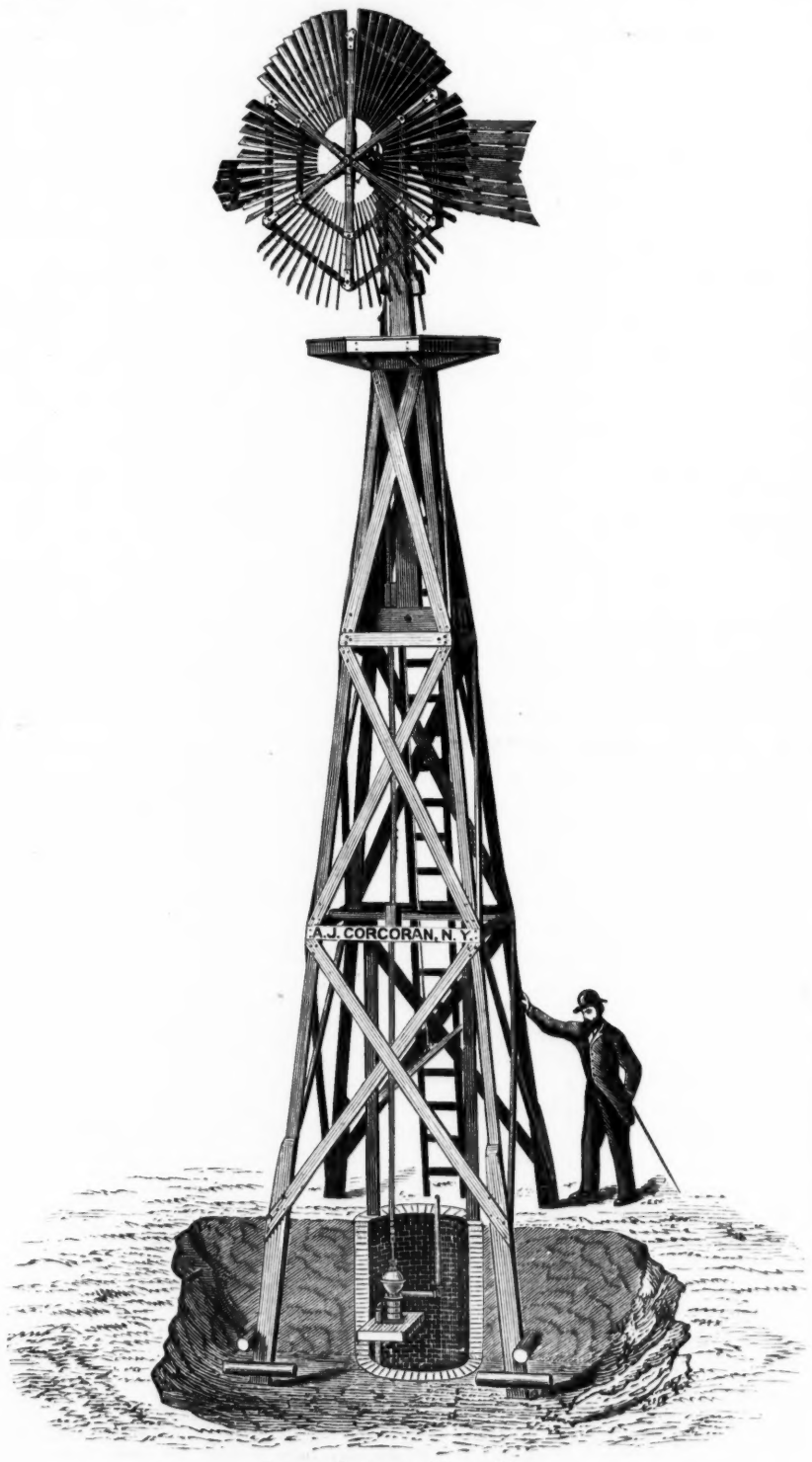
A few words may be said right here in reference to selecting a good quality of glue and using it. When a person makes a purchase of a lot of glue for which he pays a good price, the simple fact that he has paid a high price for his glue is no evidence that he has succeeded in getting the best quality. In fact, the glue purchased may be very poor. It is very desirable to secure a glue which will stand the largest amount of dampness without becoming permanently injured.

The best glue for pattern making contains very little saline matter, and when purchasing the best way to detect the presence of the substances referred to is by applying it to the tongue. By this means the presence of salt or acid may be readily detected. These tests will also reveal any bad odor which may be concealed in the dry material. Another plan is to take a cake of glue in the hands and bend it. If it does not readily yield to the strain put upon it, but shows a light color, and reluctantly breaks, the glue may be relied upon as being of a good quality. If glue is brittle and breaks short off it indicates but little strength. Some people adopt the plan of accurately weighing a portion of glue, then thoroughly soaking it in water for a day. After drying perfectly it should be carefully weighed to ascertain the amount lost in weight. The best glue will shrink but little by the application of this test.

The best glue may be greatly injured by being burnt in melting. The vessel in which the glue is to be melted should be surrounded (except the top) by water, as steam may be heated, so as to burn the glue which is located above the surface of the water. The glue which is wiped from the brush and dries hard upon the sides of the pot is by many mechanics scraped off and being thrown into the pot is again remelted. This is wrong, as the life of the glue referred to is destroyed, therefore it should be carefully taken off (when the pot is cold) and thrown away.

There are some kinds of excellent waterproof glue manufactured, but most of them have a hard, crispy nature, which is very detrimental to the edges of tools. I prefer the best quality of old-fashioned glue for pattern making, as I find the least objectionable features in using it.

In building up a pattern the grain of the wood should never be placed at right angles, as it will be only a matter of a short time when the shrinking of the wood in different directions will cause the pieces to pull themselves apart. This applies particularly to patterns made up of two thicknesses, as the wood in shrinking in opposite directions will cause the pattern to warp. It must then necessarily be taken all apart and made over again, or, as is generally the case, a new one made to replace it.



STORM DEFYING WIND MILL.

Storm Defying Wind Mill.

We present on this page an engraving of a Corcoran wind mill, 10 feet diameter of wheel, erected on a skeleton frame, corner posts 30 feet high, with anchors, and showing location of pump in well, with method of operating the same. The use of wind mills as a motive power is very old, and Mr. Corcoran has devoted eighteen years, exclusively, to the manufacture and application of wind mills, numbers of which can be seen in operation along our coast. The present mill possesses some of the most valuable improvements in this class of motors. The most noticeable feature of the mill, and the one from which it takes its name, is its manner of self-government. The wind, so disastrous to some wind mills, is in this made the governor, doing away with all springs, links, and governing balls, and using but one agent, the wind itself. The side vane and flexible rudder vane, with weighted lever, combine to produce a self-regulating movement, which is thoroughly automatic, and by this means the wind wheel is guided directly to the wind with accuracy, at all times, producing a safe and uniform speed during the most violent gales. By the late improvement, the side vane can be adjusted so as to run the mill at 100 revolutions per minute, or 10, as required, all of which is accomplished within the wind mill by wind power simply, and without attendance. The second peculiarity in this mill is its extreme simplicity. Although automatic, it has fifty less parts than the shifting-sail mill. Another advantage is that the entire working parts are mounted on an iron frame, formerly made of wood, the advantage being in the fact that all its connections can be accurately fitted in the shop, and there is no possibility of their being affected by the weather and getting out of line. The crank plate has a variety of strokes, and is provided with a steel wrist pin with nut and split collar. The pitman is made of wrought iron, the cross head of wrought iron and nicely planed off, and works in long guides lined with babbitt metal.

The whole machine is so constructed and built that it cannot be affected by any shrinkage of frame work. The power is transmitted from the wind-mill on the frame to the pump in the well by a direct balance connection, so arranged as to pass over the "dead center," when the well is 100 feet deep and the frame 75 feet high, as well as when the well is 10 feet deep and frame 15 feet high. There is no perceptible jar to mill or pump, and so accurately has this most important part of all machines been fitted, that one would not notice that the mill was in motion, unless one looked at the wheel. The mill is made mostly of wrought and malleable iron, uniting great strength and durability with lightness, a particular feature in the successful working of a wind mill, owing to the height at which it must be placed to obtain a fair current of air. As to the power to be obtained from wind mills, this is regulated by the amount of surface they present to the wind, and this mill, owing to its peculiarly constructed wheel, presents all the surface that can practically be put into a wheel of a given diameter.

Owing to the peculiar construction of the wind wheel, friction is reduced to a minimum. As the wind wheel runs so near the center of frame, and is firmly supported close up to the hub, a very decided advantage in speed, is the result.

There are but five places to oil, and these are furnished with large oil pots, and when packed and filled with oil, they will last a week without refilling. The mill can be readily stopped from the ground, or it can be arranged to stop itself, when the tank is full, and resume work again when any water is drawn from the tank.

There are ten different sizes of these mills for pumping water—from $8\frac{1}{2}$ feet diameter of wheel to 35 feet, and they have a capacity of from 200 gallons of water per hour to an elevation of 50 feet, to 20,000 gallons to same height.

There are eight different sizes of geared mills for driving machinery from 16 to 60 feet diameter of wheel, capable of developing from two horse, to 40 horse power.

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☞ *We invite correspondence from practical machinists, engineers, inventors, draughtsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

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World's Fair of 1883.

The world's fair of 1883 promises to be the most extensive, and, in its results, the most valuable enterprise of the kind ever undertaken in America. It is to be regretted that the personal jealousies of a few individuals have been developed to such a degree as to seriously impede the progress of this commendable organization. The movement, however, has now reached a point where personal rivalries will not be permitted to defeat its objects. A call will shortly be issued by the Secretary of State for a meeting of the Commissioners named in the act of incorporation recently passed by Congress, also those appointed as the representatives of states and territories. The books are then to be opened for subscriptions. At the end of September, if the minimum amount fixed ($1,000,000), shall have been subscribed, a permanent organization will be formed, a site selected and work on the buildings begun.

The act of Congress incorporating the United States International Commission, placed the capital stock at twelve millions of dollars, or two millions over the estimated outlay upon the Centennial. This extra two millions by no means carries an idea of the increased magnitude of the enterprise, as the receipts from the fact of the exhibition being located in the metropolis of the country, must be very much greater than those of the Philadelphia Exhibition. At Philadelphia only $2,312,350 of stock was subscribed, of which Pennsylvania took more than nine-tenths, thus showing that the enterprise was to a large extent merely a local one. The present incorporators, taking advantage of the experience of their predecessors at Philadelphia, will endeavor to organize the movement on a broader basis, so that the exhibition itself will have more of an international character. Its financial arrangements, in the first place, will be more complete. They do not intend to ask the national government for a cent, but believe from the public spirit manifested in the movement, that a sufficient amount will be raised by subscription. They estimate two millions to be received from public subscriptions, two millions given by the state, and one million by the city. This five millions will cover the preliminary expenses, as to site and erection of buildings, and upon these buildings any other funds that may be necessary to carry on the work until the exhibition is opened can easily be obtained.

The money received for admissions at Philadelphia amounted to nearly four millions, and it is expected to be much larger in the present scheme for the reasons given above. In addition to this there will be the sale of concessions, of which no estimate can at present be formed, but from the two sources enough will probably be obtained, to pay back the money subscribed by the public or borrowed, with reasonable interest, and the state and city, in return for their subscriptions, will have the permanent buildings which it is proposed to erect in connection with the exhibition.

The act of incorporation prescribes that the site shall be somewhere in New York city. Some ten different sites have been proposed within the corporate limits. Of course, the first suggestion refers to a location in Central Park, but the people are not likely to favor the surrender of any considerable portion of that pleasure ground for three or four years. Besides this objection it is very desirable to have the exhibition buildings reached directly by water. Of the other sites, so far under consideration, the one proposed by Mr. John Matthews seems to meet with much favor as it possesses strong advantages. It comprises a space on the East river commencing at 90th street and extending as far South as may be necessary. It is easily accessible from the Sound and the river, and would therefore be most convenient for New England visitors. It would also be the most easily reached from Brooklyn and Long Island. Between 84th and 86th streets a park is already laid out, and the work of preparing the grounds for the exhibition would not be very great. It is confidently expected that subscriptions to stock will come in rapidly as soon as the books are opened.

Auxiliary Engineers' Societies.

The prospects of the American Society of Mechanical Engineers, whose active organization, as our readers know, dates from the preliminary meeting held at the office of the AMERICAN MACHINIST, February 16th last, are so bright and full of promise for the advancement of the mechanical interests of this country, that we gladly give place in our columns to the following suggestion, which we take from the recent letter of a subscriber in Minnesota:

"I have read with pleasure of the formation of the Society of Mechanical Engineers, and would like a little space for another idea. There are a great number of young draughtsmen throughout the country who are not eligible as members or juniors to this society, but perhaps expect to be in time. Now, as I am one of that number, I propose, if there are others who think with me on the subject, that we get our names together in some way and start a system of correspondence on mechanical subjects, giving our little experience in designing for mutual help and instruction. Hoping this may meet a response from some one interested as I am, and if, Mr. Editor, you can suggest a plan, I think much good will result."

The point raised by our correspondent seems to us well taken, except in one respect, that we can see no good reasons for forming a *national* society of the kind proposed. We have more than once noticed with pleasure the organization of local engineers' societies in various cities, and we think it is to such societies that our Minnesota friend, and those who agree with him, should look for the realization of their views. In some sections, as possibly Minnesota, it might be difficult to secure a membership large enough in any single city for the purposes of such a society. In such cases, state organizations might be formed, or two or three neighboring states might join together, avoiding the expense of long trips to far distant cities.

And right here would perhaps be the point at which a further suggestion might be made, based upon the practice in vogue in the district, state and national conventions of political parties in this country. Local engineering societies might elect each year delegates from their number to represent the membership to which they belong at the meetings of the National Society, whose first meeting for the reading of papers will be held in this city next November. As such *delegates*, whether received as delegates merely, or as members, associates or juniors, according to the rules adopted April 7th, would be entitled to receive copies of all the papers read before the greater body, they would, in turn, doubtless be permitted to read suitable portions of these papers before the local societies in a manner directly calculated to emphasize the weight and influence of the National organization.

Arrangements could be made by each local society, as might be thought proper, to assess the dues and necessary traveling expenses incurred by delegates upon the society at large, thus making the *pro rata* expenditure an easy burden.

The American Society of Mechanical Engineers has already upon its rolls names from nearly every State in the Union, and from two or three of the Territories, but the plan here suggested need not necessarily tend to diminish such representation. The social and personal advantages arising from connection with the national organization could not, of course, be shared by the membership of local societies so represented, but much benefit could, unquestionably, be gained by every individual.

In our description two weeks since of the visit of the Stevens Institute graduates to the works of Henry R. Worthington in South Brooklyn, we said: "The students found but few of the elegant knick-knack drawings that they were accustomed to see, but plenty of exact and figured work was submitted for their inspection, in shape for actual use in the shop." We are informed that this passage does some injustice to the Institute practice in the matter of drawings, as the system introduced into this department by Prof. MacCord makes a special point of substituting real, every-day, working drawings for the fancy style usually cultivated in colleges and institutions. We gladly make this correction in the interest of truth and correct practice.

The series of articles entitled Practical Blacksmithing, which are being contributed to our columns by Frederick Lewis are attracting considerable attention among the fraternity. As the summer heats come on, and our blacksmithing friend warms up with his subject, readers may depend that many new and valuable points relating to this necessary department of mechanics will be put in shape for every-day use.

A good story is told of a Philadelphia pulley manufacturer. Some time ago he sold a six foot pulley to one of his customers which was immediately taken away. By a mistake of the shipping clerk, in the rush of business, no entry was made of the name of the purchaser, neither could the clerk remember who received the pulley. Investigation only showed that it must have been delivered to one of six regular customers making purchases that day. The manufacturer struck a happy expedient; he charged the pulley to every one of the six, upon the supposition that the party who received it would pay and the others call attention to the error. The result was that *four of them paid for the pulley* without a word of protest, while the other two gave notice that they had neither ordered nor received it. The latter were easily satisfied with the explanation and suitable apologies, that the clerk had made a mistake in the entry. This incident shows the accuracy with which machine shop records are frequently kept.

American Master Mechanics' Association—Thirteenth Annual Convention.

We continue our notes, on this meeting from our last issue:

The Committee on the best means of preventing noise from safety valves, reported that the general principles before the public, at the present time, for the accomplishment of the object named, are of two kinds. In the one, the stream of the escaping steam is finely separated before reaching the open air, usually, by passing through a chamber, and thence to the open air through a number of small holes, or fine tubes, or through layers of glass beads. The second method is to prevent the steam from escaping into the open air at all, and to convey it by pipe to some large reservoir.

In locomotives this reservoir is usually the tender. When the first method is applied to safety valves, it is open to the objection that it interferes with delicacy of the adjustment. It is not merely that it creates a back pressure, but what is a greater evil, the back pressure is variable in its action making the valve unreliable. The second method avoids this trouble, and has the advantage of utilizing some of the heat that is otherwise entirely lost.

There is another advantage which, though incidental, is none the less real, and indeed forms a very valuable feature referring to the heating of the water in the tender. This acts as a decided check on extravagant methods of firing, for, though it is very beneficial to have feed water moderately heated (say less than 120°) a higher temperature will give engine-men great trouble in using injectors. Excessive blowing off of steam will overheat the water, and engine-men having once experienced this trouble, will be more careful of their fire in future. With many engine-men, this check alone, on reckless firing, leads to a surprising economy of fuel. The difficulty of controlling the fire with engines of present construction, will also be made apparent to those who design them, and this will probably lead to their engines getting proper ash-pans, with tight dampers, so that opening the fire door will not be the sole means in the power of the engine-men to regulate the fire.

The Committee urged the question as being very important, and that the noise of escaping steam, especially from safety valves, ought to be regarded as an intolerable nuisance, and a disgrace to those in charge of locomotives. In closing the Committee expressed a desire to see the day when locomotives will be built with sufficient care, and engine-men trained with enough intelligence, to render the application of any special device for hiding the evidence of neglect, unneccessary. But at the present time they are driven to use such special means for accomplishing the desired end and in doing so it is best to hide not only the sound but the sight of the steam, for both add to the distractions already too numerous in railroad working.

The report of the Committee on tools and machinery contained but little that is new but they intended the statements contained in their report to call forth discussion, and suggest ideas for future examination. The following is a summary of the statements made by different persons under this head:

Fine Cutting and Scarfing Machine designed and built by J. Johann, M. M.—The method which I employ of piecing flues is by bracing, and as the old methods of cutting and scarfing required considerable time and labor, it became desirable to have a machine designed to perform this work specially. (A drawing was here shown illustrating the machine referred to.) It consists of a plain box stand having a cast iron head, movable around a central pivot. This head supports a stepped pulley and hollow spindle through which the flue is passed and held by means of a three-jawed chuck. When cutting off flues the head is placed central and bolted down by means of side bolts. When scarfing it is turned to the right or the left according as the scarf is to be on the outside of the flue or inside of the flue piece. After scarfing the flue piece, the tool is pressed up against the edge, when a shoulder on the tool turns the edge over. The flue and piece are then pressed into each other, when it is ready for the brazing wire. The advantages of this machine are: 1. In the rapidity with which the work may be performed. 2. It secures a perfect joint and a straight flue. 3. In permitting the use of cheaper labor, as it is so simple a boy can and does tend it. 4. Its capability of performing other work when fitted with a different chuck.

Slide bar, grinding and truing machines.—The lower part of this tool resembles a small planing machine. Its narrow traveling bed is hollow or dished, has pinching screws at sides to hold the slide bar, and is partially filled with water to keep the bar cool. On the upper portion of the fixed frame is mounted a dry emery or buffing wheel six or seven inches broad, having a slow side traverse as well as a quick revolving motion. A board, leather or rubber apron is attached to each end of the traveling bed (falling over carrying rollers at ends of the fixed frame) to keep the slides of the machine free from grit and dust.

Its work is highly finished on the wearing surface, true and free from winding, and a single bar machine will turn out from eight to ten slides per day, or barely one per hour, and a man could attend to more than one such tool if required.

The advantages of the flexible shaft were also fully explained, and its peculiar adaptation to use in boiler shops and in repairs.

Moulding Machines.—If, as often happens, when the rolling stock is reduced to standard—castings are daily being made from one pattern—a moulding machine will reduce the cost of labor to a low figure. Its construction is simple. A stout cast iron plate is mounted on trunnions with half of pattern standing out in relief on each side of this reversible plate, which is also provided with pins to temporarily secure the moulding flasks down to plate. A boy is capable of operating this machine, thereby doing away with much skilled labor. Perhaps it is in the brass foundry, making journal bearings for car axles, that its value will best be realized.

As an economical portable power, to be used in shops for boring cylinders and other purposes, a steam pipe 2″ in diameter may be run around the shop to each of the stalls, and a portable engine attached at any of the places named. This engine may be easily transported from one place to another.

It was recommended that a circular saw be placed in smiths' shops for cutting up bar iron and for cutting or trimming forgings. Other shop tools and practices were proposed and discussed.

The committee on subjects reported the following topics for the next meeting:

1. Boiler construction and improvement.
2. Shop tools and machinery for manufacturing and repairing locomotives.
3. Best means of obtaining a higher economy in the use of bituminous coal.
4. Best form of construction for locomotives for passenger service.

LITERARY NOTES.

The J. N. Mills Publishing Co., of 165 Broadway, New York, and 10 Pemberton Square, Boston, have just issued their New England Directory of Manufactories, Steam Boiler and Engine Owners, arranged alphabetically by city and town, showing the full address of each and stating the number of steam boilers owned by each. It includes Massachusetts, Rhode Island, Connecticut, Maine, New Hampshire and Vermont, town by town; is very complete and will be very useful, containing over 200 pages. Price, $5.00. A similar directory covering the states of New York and New Jersey is now in course of preparation. Our readers will remember that some weeks ago we noticed a similar directory containing names of steam boiler owners, and engineers in charge of same, covering the cities of New York and Brooklyn, and published by the same firm, which, we learn, has had a large sale.

Questions and Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common sense methods.

(1) G. L., Hartford, Conn., asks: Could you inform me what chances there would be for a machinist on the island of Cuba in such positions as running stationary engines or superintending sugar machinery, and where I should apply for such a situation? *A.*—We would say that the chances at present are not very encouraging, and unless you can make a contract with your employers before leaving this country, you might better stay at home. You would probably in a few years lose your health, as others have done, and thus through sickness be compelled to succumb without money. The United States offers advantages which are not to be found in any other country.

(2) H. N., Springfield, Mass., asks: Will you tell me the simplest way to calculate the speed of a counter shaft, which is driven from the main line of shafting? *A.*—Multiply the diameter in inches of the driving pulley upon the main line shaft by the number of its revolutions per minute (which may be counted by a watch), and divide the product by the diameter in inches of the driven pulley upon the counter shaft. The quotient will be the revolutions per minute of the counter shaft. If a pulley be located upon the counter shaft, and it is desired to ascertain the diameter of a pulley necessary to drive it at a given speed, then multiply the diameter of the pulley upon the counter shaft by the number of revolutions per minute, and divide the product by the number of revolutions of the main line. The quotient will be the diameter of the pulley required to be placed upon the main line.

(3) H. H. L., Johnstown, Pa., asks: Will you please inform me through your paper how seamless brass tubing is made? I have seen brass tubing that was seamless and perfectly smooth inside and out, yet evidently it was not turned. How was this made? *A.*—A sand core is first made and placed inside a mould, after which the melted brass or copper is poured into it. The casting thus made is then annealed, after which a mandrel is placed inside and the tube is drawn cold through a series of steel dies, which gradually reduces the thickness, until finally it is passed through a finishing die, which gives the pipe the finished appearance that you refer to. In some cases the cast tube when first made is only about 5 feet long, and when finished is sometimes drawn to a length of over 30 feet. To get all the details it would be necessary to visit a tube works and make it a practical study.

(4) J. L. B., Indianapolis, Ind., asks: 1. Will you please inform me of the best method of setting an engine shaft in line with another, which is already in place, to be directly connected with flange couplings? *A.*—Stretch a fine line along the side of the shaft already in place at the same height, and a convenient distance from the center. The end of the line may be allowed to extend beyond the end of the shaft to any required distance. The position of the new line or engine shaft may be easily determined by measuring from the line referred to. The flanges upon the couplings should be brought squarely together and the shaft leveled. 2. Please refer me to some standard book on millwright work. *A.*—"The Miller, Millwright and Engineer's Guide," by H. Pallett, also the "Practical American Millwright and Miller," by David Craik, are good works on the subject named.

(5) A. R. C., Harrisburg, Pa., asks: 1. Would a square foot of cold iron be larger or smaller if heated to 4,000° or 5,000° Fahrenheit? *A.*—We would say that it will occupy more space when heated up to the temperature mentioned by you. Iron becomes a fluid at a temperature of from 2,800° to 3,000° Fahrenheit, depending upon the quality. The temperature of the Bessemer furnace is about 4,000°, and it would be a very difficult task to measure the space occupied by a mass of iron at that temperature. If any of our readers know of a circumstance where it has been done they will confer a favor by informing us. There is a theory that a piece of cold iron may be heat up nearly to the point where it begins to melt, at which point it begins to shrink and continues to do so until the molecules of metal have melted or changed their shape, after which the metal will again begin to expand, and continues as the heat is increased. When a body is fusing, no rise in the temperature occurs, however great the additional quantity of heat may be imparted to it, as the increased heat is absorbed in the operation of fusion. 2. Why is it that a piece of solid iron will float on a ladle of melted iron? *A.*—A body in a liquid is buoyed up by a force equal to the weight of the liquid it displaces, and a body to float in a liquid must of necessity displace an amount of liquid exceeding its own weight. By the use of this principle iron may be made to float upon water. In this case, we would say that the cause of the solid cast iron floating upon the liquid cast iron, is owing to the foregoing principles, *i.e.*, the liquid iron is more dense than the solid, and there is always more or less ebullition going on in a ladle of melted iron which always has a tendency to lift a solid body placed therein. It may also be largely owing to the difference in temperature, as, for instance, ice will generally float in water if the difference in temperature be less than 32°, but if ice of less than 16° be put into water of more than 48° it will sink. A piece of solid cast iron when put into a ladle of melted cast iron is more buoyant upon the surface of a low temperature than that of a higher temperature. In other words, if the temperature of the molten iron is at a white heat, as in a Bessemer furnace, a piece of solid cast iron placed upon the surface will sink. 3. What are the relative amounts of carbon in cast iron, wrought iron and steel? *A.*—A pure iron, when combined with 2 to 5 per cent. of carbon, is fusible cast iron; with less than ½ per cent. is malleable iron, with ½ per cent. is very soft steel, while 1 per cent. is cast steel. With 1.4 to 1.5 per cent. of carbon, iron denotes maximum of strength with hardness, 1.75 of carbon steel weldable in a slight degree, 2 per cent. fusible cast-iron. 4. Is there more carbon in hard cast iron than in soft? *A.*—Yes. The hardest cast-iron, which is known as "white iron," contains about 5⅓ per cent. of combined carbon, which varies with iron ores from different localities.

Business Specials.

40 cts. a line for each insertion under this head.

Van Allen & Co., Iron and Nail Works, Northumberland, Pa., write: "The No. 4, New Pulsometer, with 9 ft. 2½ in. pipe as suction, and 12 ft. of 2½ in. as discharge, worked by ⅛ in. steam pipe, continues to work to our entire satisfaction, requiring no attention, and discharges constantly a 2⅛ in. stream, from Monday morning until Saturday noon, when we stop the supply of steam." New Pulsometer Office, 40 John St., N. Y. Send for new book.

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Manual of Power for Machines, Shafts, and Belts, with the History of Cotton Manufacture in the United States, by Samuel Webber, C. E., copyrighted 1879. Only work of the kind extant; 240 pages. Price $3. Address, D. Appleton & Co, New York, or the author, Manchester, N. H.

Sheet Metal Presses. Ferracute Co., Bridgeton, N.J

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Second-hand 80 H. P. Tubular Boiler for sale cheap; also one large Blower. David W. Pond, Worcester, Mass.

MANUFACTURES.

The question, Where do all the pins go to? may at this day give place to, Where does all the wire go to? On a recent visit to the extensive wire mills of the Washburn & Moen Manufacturing Company, Worcester, Mass., we were informed that they are now employing 2,500 men, and are pushed to fill their orders. They are enlarging by putting up new buildings every few weeks. Two of their largest departments are those of barb fence and telegraph wire. They have the best improved machinery and thorough systems for wire making.

Every machine tool builder in Worcester is complaining that skilled mechanics are very scarce and difficult to obtain. They are all full of orders, some having all they can fill for three or four months to come.

We lately noticed in the shop of David W. Pond, Worcester, Mass., a huge engine lathe in course of construction for Bliss & Williams of Brooklyn, N. Y. It is eighteen feet long, and has a 64-inch swing. There are fifteen changes of speed regularly graded. The lathe has some new apparatus for changing the gears. Its weight is sixteen tons.

It is said a stock company, with a capital of $300,000, are to build machine shops at Pottsville, Pa.

Mr. George Richards, formerly connected with the firm of Richards, Hand & Taylor, of Philadelphia, and more recently acting as manager of the Standard Gauge department of the Betts Machine Co. of Wilmington, Del., has resigned his position with that company at the first of this year. He has now under contemplation the starting of a shop to manufacture certain improvements in standard measuring machines, reamers, etc.

The foreman of one of the departments of C. Aultman & Co., Canton, O., writes:

We are and have been since March 1st running eleven and one-half hours per day, turning out twelve engines, 10 H.P. agricultural, per week. Now we are working exclusively on traction engines, turning out 10 a week. The AMERICAN MACHINIST is perused with great interest, and the majority of the boys say they would not be without it under any consideration.

E. & T. Fairbanks & Co., of St. Johnsbury, Vt., are setting a new steel boiler, made by the Whittier Machine Company, with the Jarvis Furnace.

WE would state by way of correcting an item in week before last's issue relating to a mining engine and other machinery being built by the Whittier Machine Company for the International Vacuum Mining and Dredging Company, that Frazer River, their base of operations, is in British Colombia instead of Colorado. The machinery being built for this company is a large locomotive boiler, to be set on a dredge boat to supply steam for the vacuum chamber used for raising the sand and gravel from the bed of the river, and also to supply steam for the hoisting engine situated thereon.

Machinists' and Engineers' Supplies.

NEW YORK, May 27th, 1880.

There is little if any improvement in the supply market this week, and since the heated term has sprung upon us so suddenly, dealers seem to prefer remaining in their offices, and trying to keep cool and let prices settle themselves.

There has been a decline of 2c. per pound on sheet copper, also on O'Neill's planished copper.

The American Screw Co., Providence, R. I., have reduced the price of Iron Black, Iron Tinned, Block and Carriage Rivets, from 30 to 40 per cent. discount, and of Rivets in Bulk, and Burs, from 10 to 20 per cent. discount.

Wrought Iron pipe is quoted 65 to 70 per cent. discount from list.

The Geo. F. Blake M'f'g Co. of Boston and New York, are just issuing a very handsome and complete illustrated catalogue of pumping machinery for all uses, blowing engines, &c.

Mr. J. D. Foot, formerly agent of the firm of Weinmann & Kearney, has formed a co-partnership with Mr. James Kearney, under style of Kearney & Foot, for the manufacture of fine grades of hand-cut files. N. Y. office, 78 Chambers St., and factory at Paterson, N. J. They have issued a neat pocket price list of files, with hints about using them, which will be mailed on application, or presented to any caller in person.

The firm of Ware & Ballou has been formed in Worcester, Mass., for the manufacture of a new emery wheel called the "gem." It is not baked or pressed, and is ready for use in twenty-four hours after making. It is claimed to be uniform and not affected by moisture.

Iron Review.

NEW YORK, May 25, 1880.

As noted last week, the market for pig has a slightly improved appearance. There is more inquiry and more sales. Quotations remain nominal at $25 for No. 1, $24 for No. 2, and $23 for forge. Sales have been made from second hands at less prices, but as there is no falling off in consumption, prices are likely to soon recover. Old rails are about $2 a ton higher.

Pierson & Co., 24 Broadway. N. Y., under date of May 27th, 1880, quote prices out of store as follows, although they say prices are nominal:

Iron Rails, $52½ to $57½, according to weight; Fish Plates, 2¾c. per lb.; Railway Spikes, 3¼c.; Bolts and Nuts, 3¾c.; Common Bar Iron, nominal, 2 7-10c., basis from store; Refined do. 3c., basis; Ulster, 3 6-10c. basis; Machinery Steel, 6½c.; Best Tool Steel, 13½c.; Norway Bar Iron, 6¼c.; Norway Shapes, 6¾c.; Nail Rods, 6¾c.; Sheet Iron, 4c., basis; Angle Iron, 3 6-10c.; Tee Iron, 4¼c.; Band Iron, 3½c.; Hoop Iron, 3 7-10c., and up according to size; Horse Shoe Iron, 3½c.; Hot Polished Shafting in lengths, 2 ft. and longer, 9 to 10½c., according to size; Small Black Rivets, 30% off in papers; 10% off in bulk.

Carmichael & Emmens, 130 Cedar St., New York, quote prices of Boiler Makers' Supplies as follows:

Flange, 5c.; C. H. No. 1 Shell, 3¾c.; Tank, 3c.; C. No. 1, 3½c.; Boiler Tubes, 52½% discount from list.

Metal Review.

LUCIUS HART & CO., 8 & 10 Burling Slip, New York, furnish us the following, under date of May 27th, 1880:

Metal market not materially changed since our last report. Pig Tin in London £73; Singapore $22½. This market nominally Banca tin 21c. Malacca Straits & Australian 16½c to 17c. Billiton 16c. English refined 16¼c.; "Lamb & Flag." 17c.; Pig Lead 4¾c. jobbing lots. Antimony, 20c. for Cookson, 18c. for Hallett; Spelter, 6c. for Foreign, 5¾c for Domestic; Ingot Copper, 18¾c.; Nickel, $1.25; No. 1 Solder, 10c.; Half and Half, 12c.

WANTED.

Wanted—Ten first-class moulders. Address Holyoke Machine Co., Holyoke, Mass.

Wanted.—Two or three good journeymen machinists, used to machinists' tool work. A.F. Prentice & Co., Worcester, Mass.

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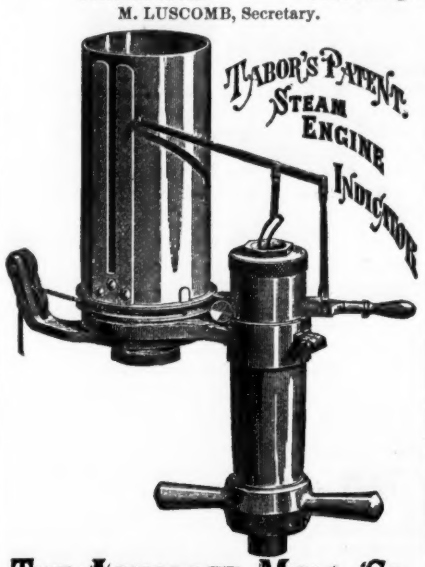

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The Cambridge Boiler Explosion.

An examination of the attack, in the columns of "The Boston Daily Advertiser," upon the judicial decision.

By J. R. ROBINSON,
40 PAGES. PRICE, 10 CENTS.

Mr. Robinson brings out, in the course of this review, information of great value in relation to boiler engineering. He also shows that there has come to be in our boiler construction and inspection a disregard of the standards of the authorities, of grave concern to all who are responsible for the safety of steam boilers.

"The pamphlet contains important suggestions which we are obliged to omit for want of space. But we commend them, and the reasons on which they rest, to all that are interested in the subject."—[Daily Advertiser.

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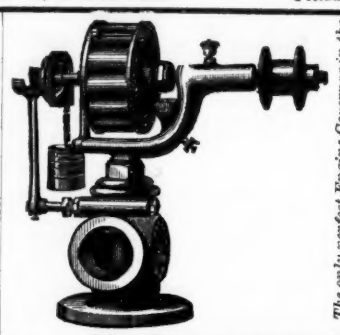

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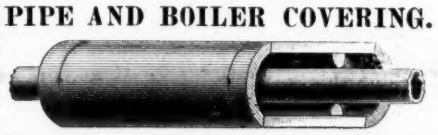

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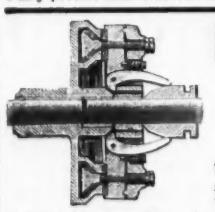

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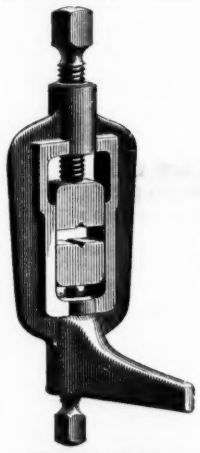

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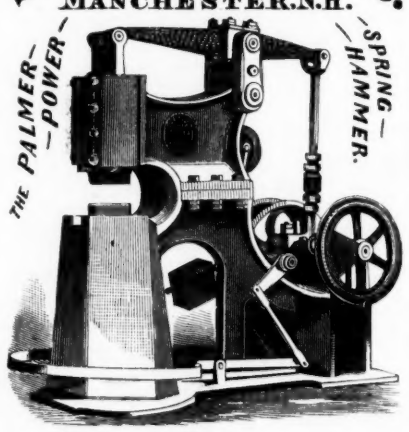

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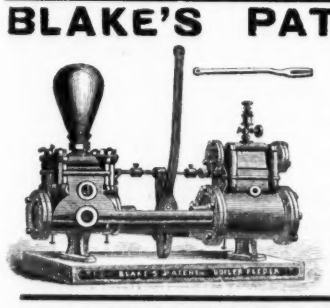

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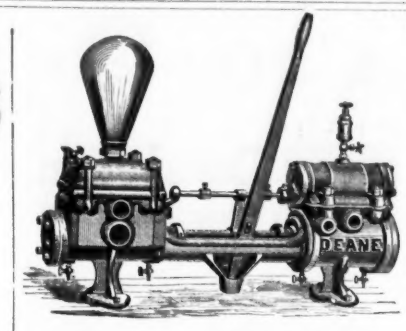

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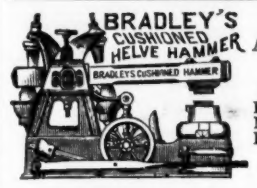

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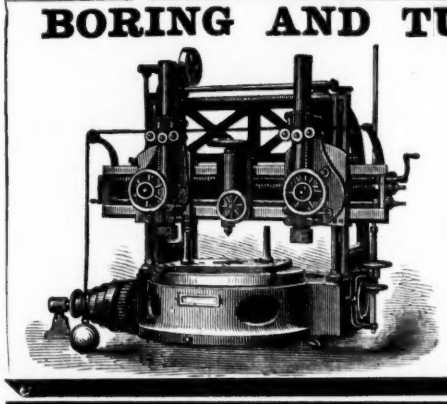

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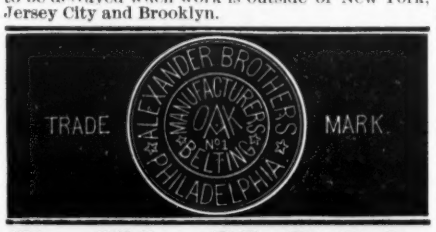

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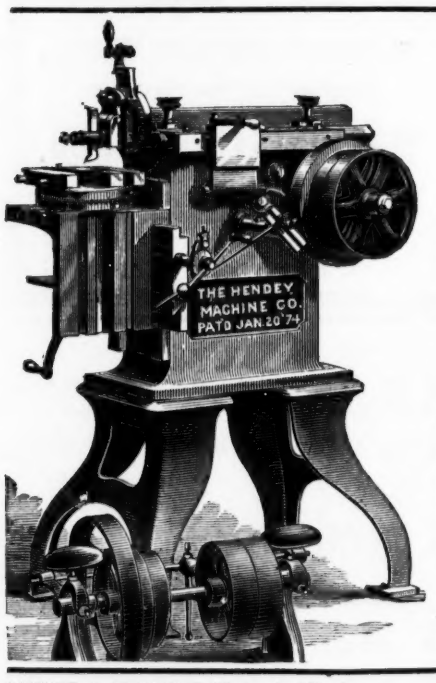

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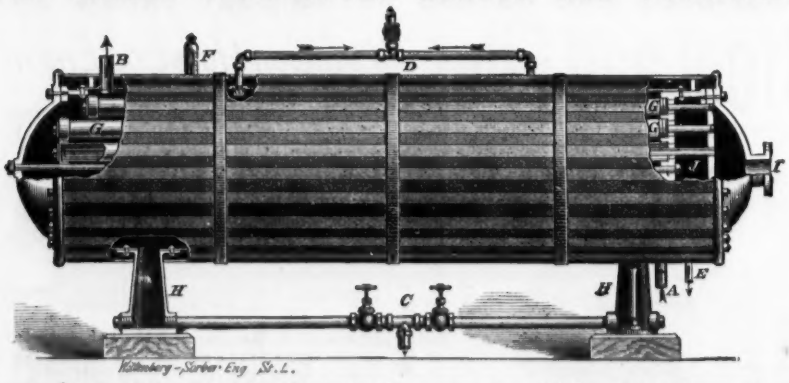

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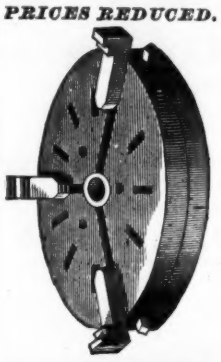

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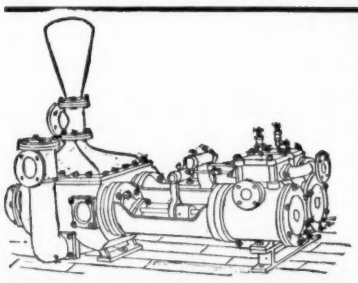

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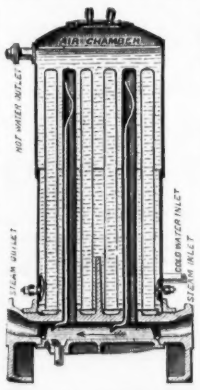

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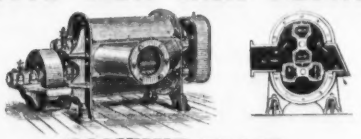

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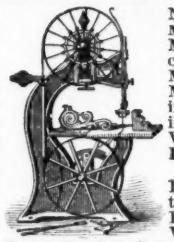

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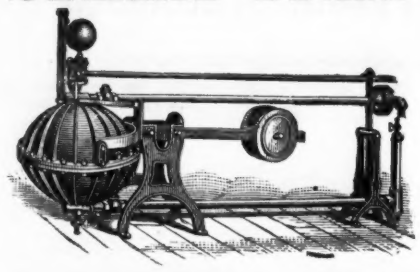

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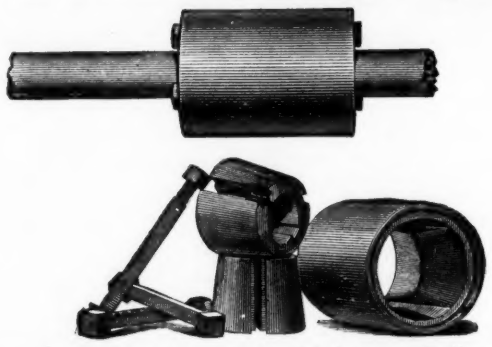

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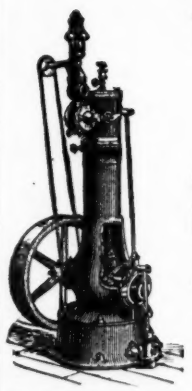

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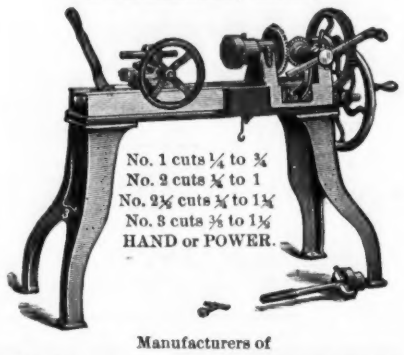

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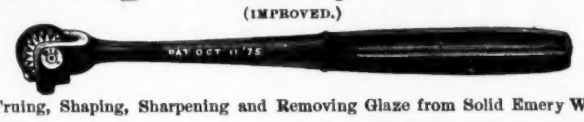

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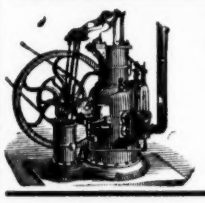

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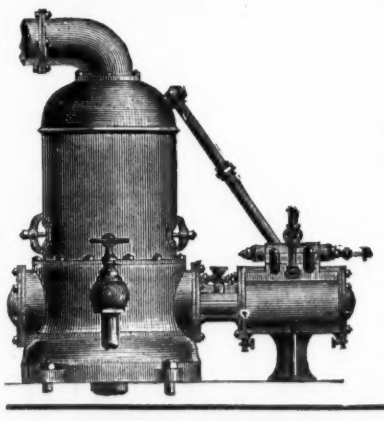

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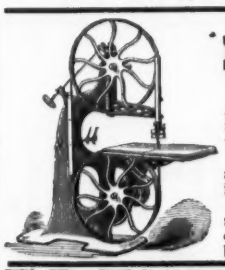

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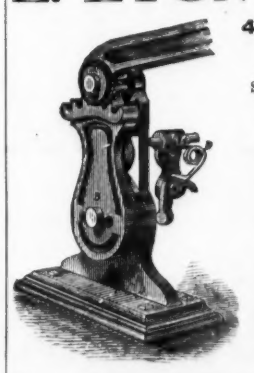

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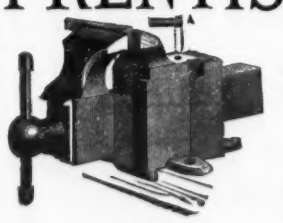

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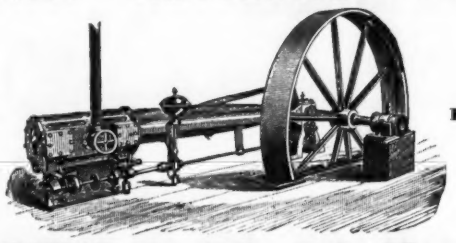

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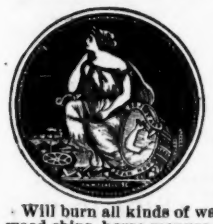

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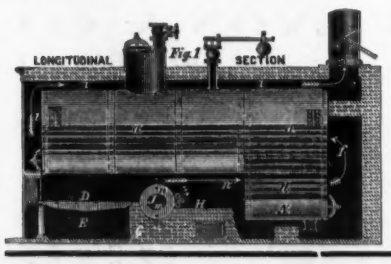

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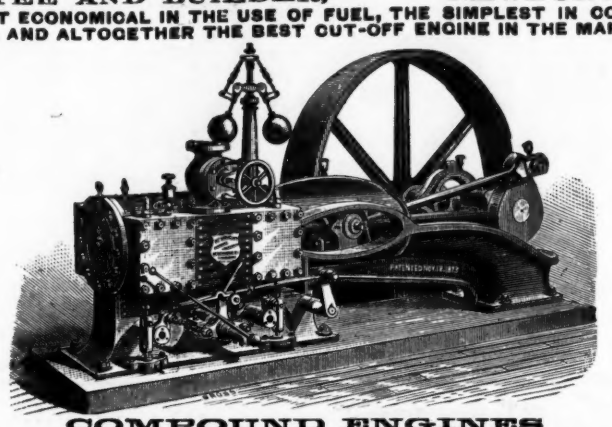

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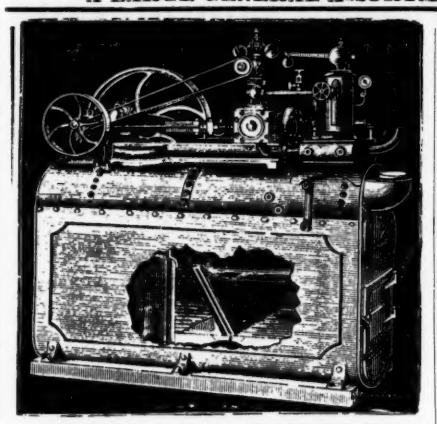

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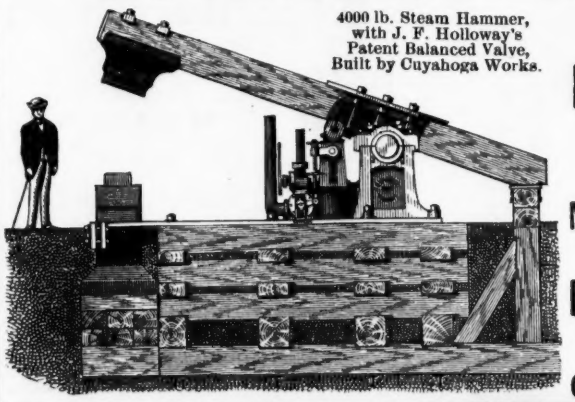

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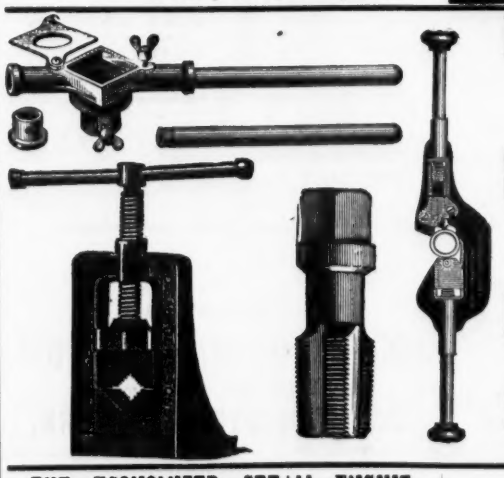

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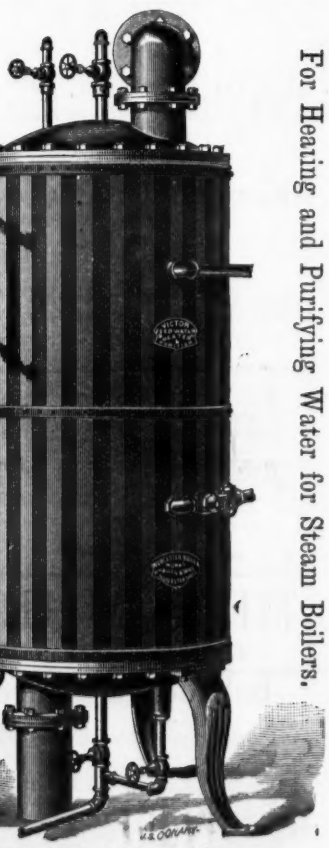

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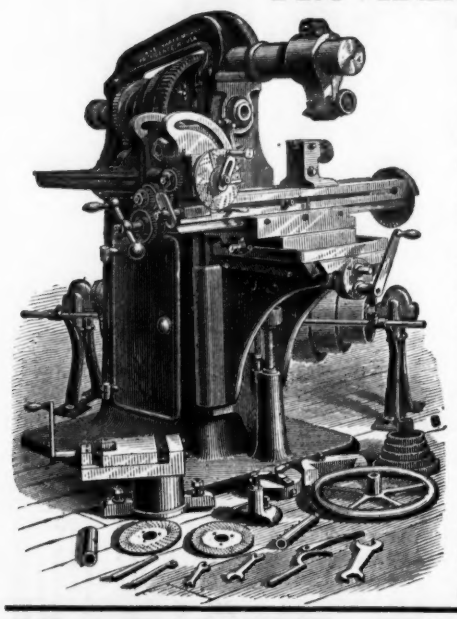

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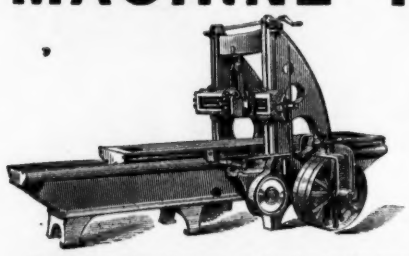

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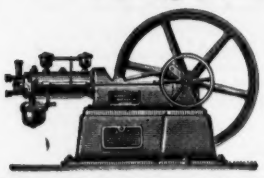

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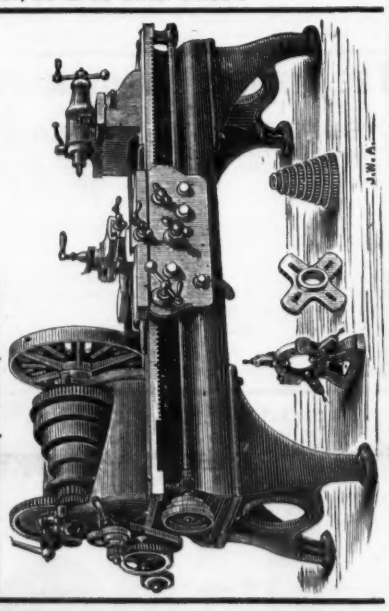

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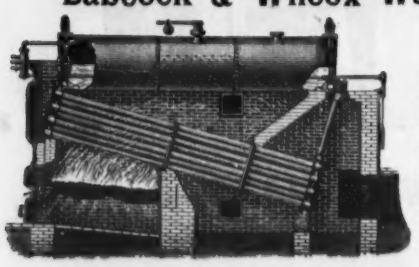

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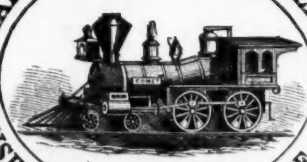

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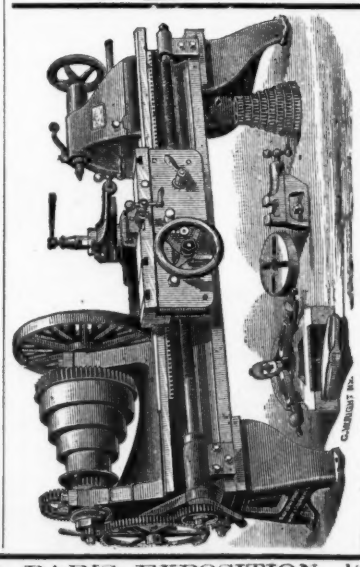

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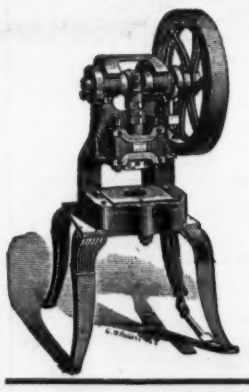

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